

Tricks for Driving Two-Lane Roads

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POPULAR SCIENCE

AUGUST • 35c Monthly

Fixing Your Own TV

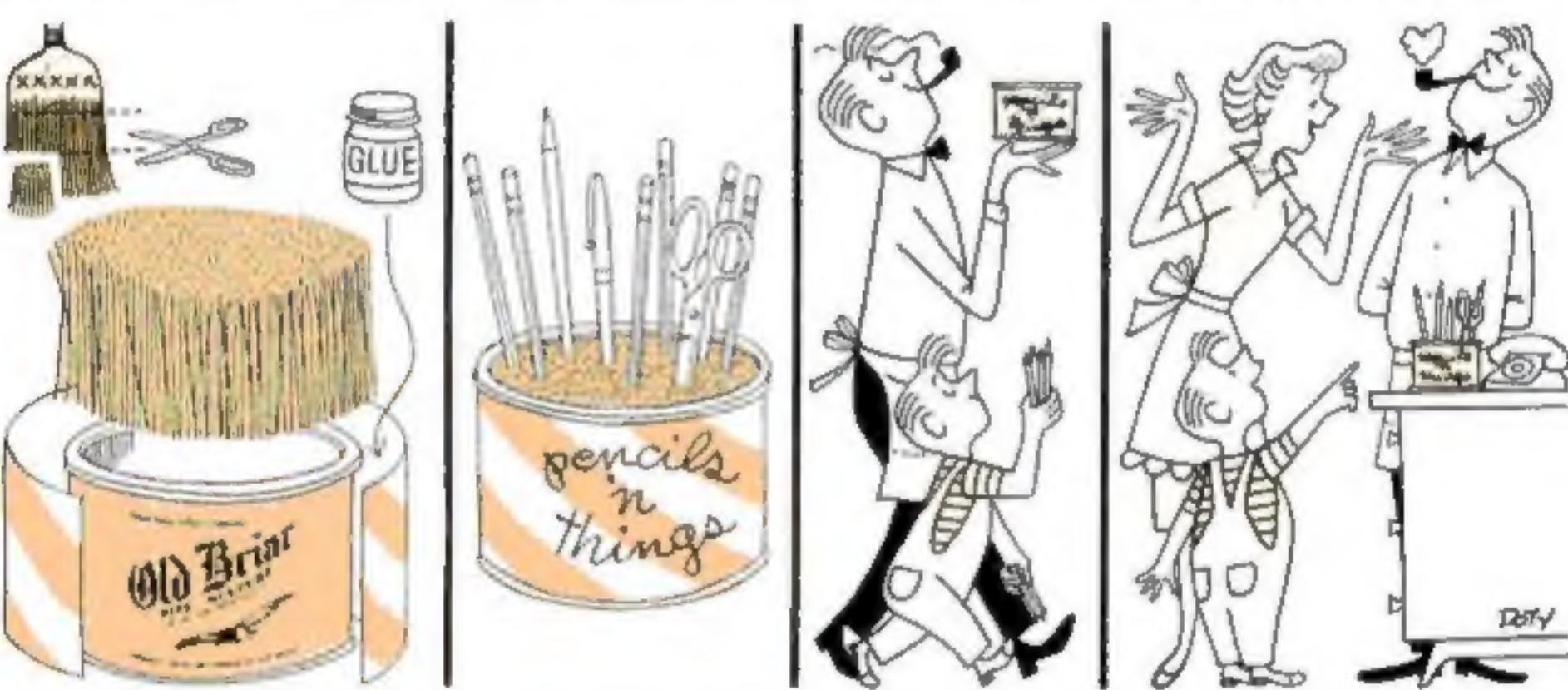
Money-saving
series starts
in this issue

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BERNARD A. SCHRIEVER, USAF

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Allergy: Sick? Maybe it's egg white—or money. P. 86



Open Wide: They're taking the ouch out of dentistry. P. 59

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Popular Science

August, 1960

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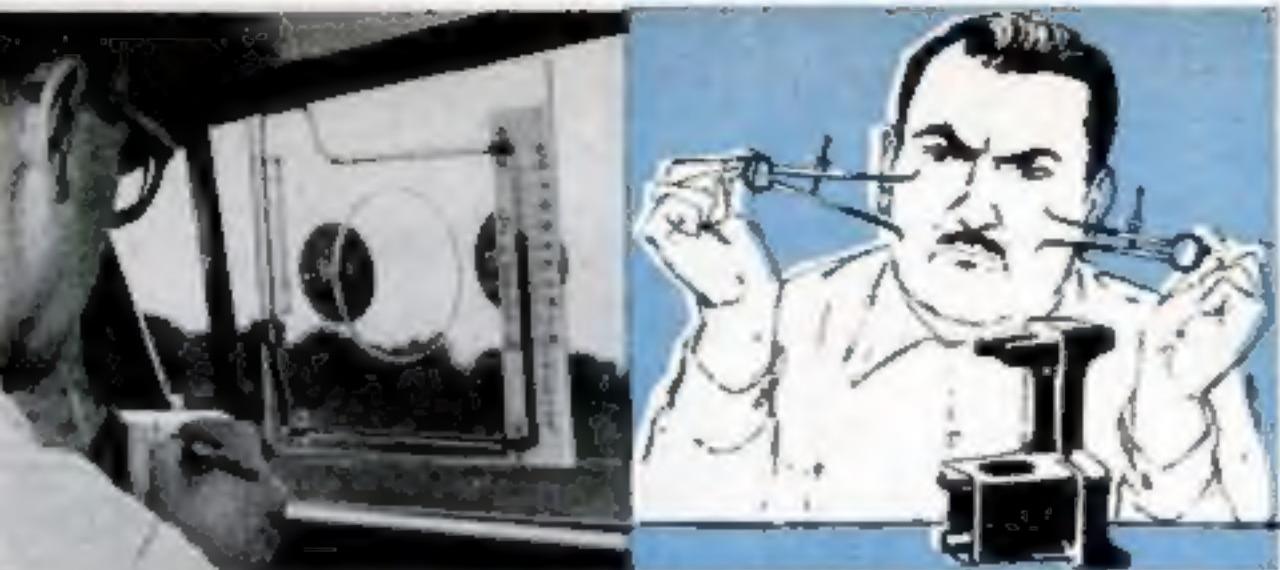
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GAB Meter: A finger on your car's pulse. P. 155

Old Engine: It shrieked defiance to the end. P. 147



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PS Readers



Defense Against Burglary

PROPERLY taken to heart, "Your Best Defense Against Burglary" [May] could help to cut down the one-burglary-per-minute record in this country.

One thing should be added regarding door chains. Most of them are not really safe. Either they are not heavy enough or their screws are too small to withstand real force. In our house, a 2½-year-old child once chained the door while I stepped outside a moment. On impulse, I threw all my weight against the chain and it broke on the second push (and I'm no heavyweight). We now have a much heavier chain.

G. O. LYCHOUR, Cleveland.

. . . THE best defense against burglars may be to hide in your bed, but you forgot to advise covering your head with a pillow. That way, if your daughter screams as she is attacked, you won't hear her. The noise could be disturbing and lead to loss of sleep.

"The last thing any cat-man wants is trouble," so to encourage these fine citizens in their chosen work you say "do absolutely nothing . . . he'll take what he wants and silently fade into the night." Let's all form a club for the preservation, encouragement, and abetment of burglary. All joiners can place their property in their carports and hang out a sign saying "Help yourself, but please leave quietly."

This Republic was founded by people who believed in defense of the home, even at risk of death. There were few burglars in those days. But the present attitude—"It's only money, let him have it"—simply encourages the criminal.

A. A. SHEDDAN, Jacksonville, Fla.

. . . YOUR article on how to act when someone breaks in seems to be saying

TALK BACK

that the intruder must be pacified at all costs. Would it not be better to picture the home owner as alert, more than likely armed, and most determined to protect his home? If anyone must be warned, let it be the criminal element.

CECIL F. HAYS JR., Richmond, Ind.

Water-Cooled Cars on Way Out?

AFTER reading "Behind Those Corvair Stories" [May], I feel that most car buyers do not yet appreciate the tremendous advantages of the air-cooled engine. Probably this is because Chevrolet is soft-pedaling it. This is understandable since they're still pushing their big water-cooled cars.

Could they be planning a larger air-cooled engine for their top line? The engine in the old Franklin had much on the water-cooled ones of its era. Perhaps Chevrolet's departure signals the beginning of the end for all water-cooled cars.

G. F. STILLWELL,
Manhattan Beach, Calif.

Plaint of a Would-Be Joiner

THERE seems to be a lack of organizations for the home machine-shop experimentalist, or for the do-it-yourself home builder.



If any readers know of anything being done along these lines in any part of the country, I'd like to hear of it.

E. GROSSMAN, Brooklyn, N. Y.

Fire Underfoot

ALTHOUGH "Inferno Under a City" [May] describes an appalling situation, coal-mine fires are not new to Pennsylvanians. In a tract directly east of the present holocaust, a fire of very many acres burned from about the turn of the century up until a few years ago. My grandfather told me it was started by hot ashes.

The fire was in the upper veins, and at night the gases could be seen burning.

"THEY TOLD ME I DIDN'T HAVE WHAT IT TAKES!"

The words hurt. But deep down I knew what the boss was saying was true.

"Sure you're a good man, Frank. You work hard. What we need, though, are men with special training. Job specialists who can come up with the right answers. Nowadays experience isn't enough."

So there was the answer. Why other younger men were moving ahead, earning pay raises, getting the good jobs. Why I was being left behind.

I just didn't have what it takes.

You feel desperate at times like that. Family to support. Job to hold down. No chance for the future.

Then I heard about I.C.S. How I.C.S. had helped others like me get the job training they needed to get ahead. Some even found new careers.

I figured maybe I.C.S. could help me. I clipped



out the coupon from an I.C.S. ad and mailed it in. The free career kit I received a few days later convinced me to sign up for a course.

Things began to happen after that. The instruction was practical, down to earth. It seemed what I learned the night before I was able to apply on the job the next morning.

Word got around I was taking an I.C.S. Course. My boss learned of it and three months later I got a raise. Six more months and I got another. Now I'm looking forward to a promotion.

Once in a while I remember the time the boss said I didn't have what it takes. Makes me smile now. But still I thank my lucky stars for I.C.S.

Maybe you will, too.

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Many, many tons of coal continued to be mined below the fire and the hot strata rock that separated the veins. Many a driveway was made from the ashes (red shell), too.

F. A. HELMS, Weehawken, N. J.

How to Lure a Gopher

SAW your tip on getting rid of moles [April, p. 206]. Out here we have a gopher problem. How a gopher likes to raise hob with lawns and gardens! A trap will catch him, of course—if you can get him in. Here's how to lure in Mr. Gopher and his whole family.

Go to the dime store and buy a bottle of the cheapest and smelliest perfume. Put this in an atomizer and spray the



poison or the trap with it. For some reason, gophers find such an odor irresistible, much to their final chagrin.

P. J. SHULER, Acton, Calif.

S.O.S. to Worm Raisers

I'M RAISING red worms for fish bait. Can anybody come up with some "Short Cuts and Tips" on how to raise a lot in a short time?

W. S. HASTY, High Point, N. C.

Pros and Cons on Speed Laws

IT IS not the fast, steady going that kills [Let's Abolish Stupid Speed Limits," May], but the skull-smashing, blood-spilling, gut-rending, bone-breaking stop—regardless of the speed before it. You ignore the well-established fact that no matter what the type of accident (roll-over, head-on, car out of control), the severity of damage and injuries increases as the speed of the car increases. Furthermore, the degree of drunkenness or inattention that the laws of physics will tolerate is far less at 70 than at 25 m.p.h.

J. R. HYNDMAN, Levittown, Pa.

. . . I'VE had few accidents, but had one head-on. In this case, I was on my side of the road in a snow storm, going

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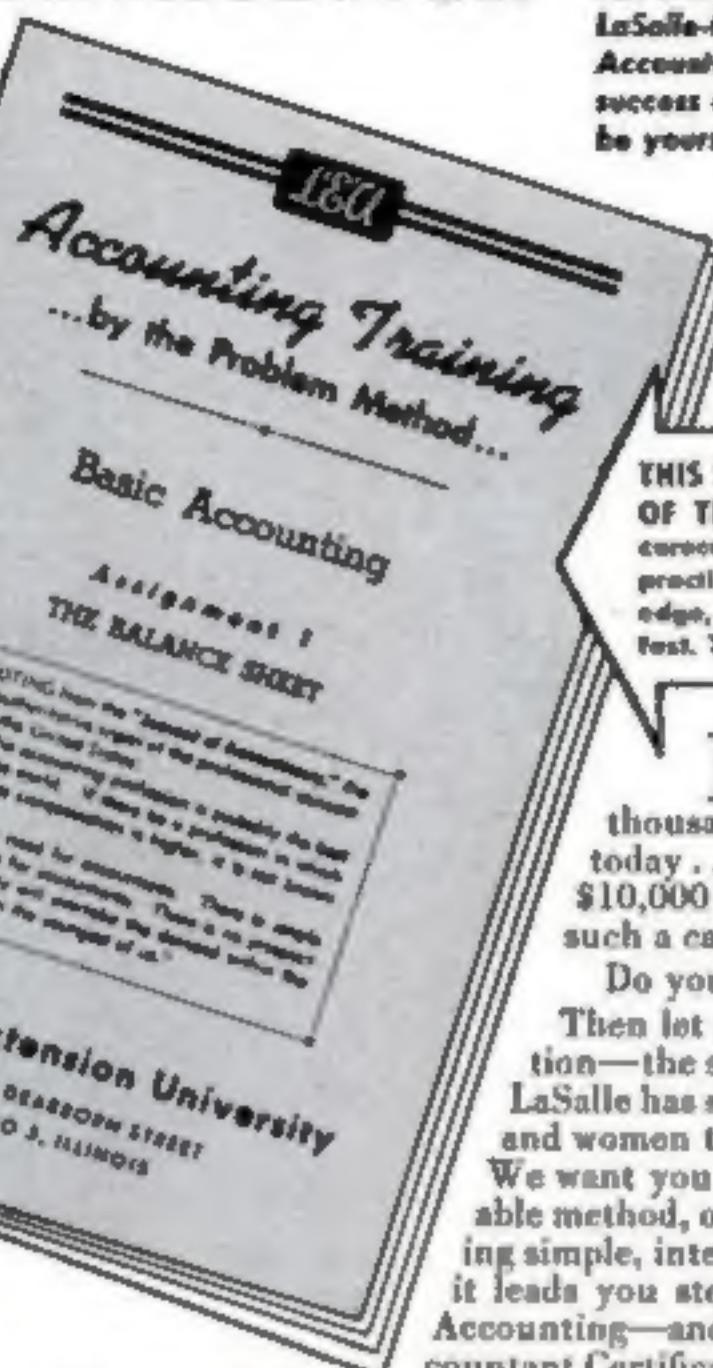
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about 18 m.p.h. A car coming toward me at about 40 skidded to my side of the road, hit my right front fender and went into a ditch at my right side. This was definitely a case of speeding (for condition of the road). It would be silly to say it was my fault for going too slow. I at least had control of my car.

ED RAPPUNN, Sheridan, Wyo.

. . . Most accidents are caused by three factors: inattention, improper car maintenance, slow drivers in fast zones. Speed limits should be dictated by conditions prevailing, not by individuals trying to



further their political careers by adding money in the form of speeding fines to the county treasury.

L. FURSMAN, Atlanta.

. . . How about printing percentages of car-accident fatalities at various speeds? You say that three out of four accidents involved cars traveling at 50 or less. Are you actually saying that if these drivers had been exceeding 50 m.p.h., they wouldn't have been involved in accidents? You'd just have more horrible, headline-making accidents.

J. FORD, Marietta, Ga.

. . . ANYTHING that slows down his reactions forces upon the driver a responsibility that has to be recognized. Often, on the highway, the split-second decision becomes truly a life-and-death consideration. To save lives, drivers must sacrifice even the most moderate drinking.

A. K. TAYLOR, Baltimore.

. . . It's a real thrill—and a great discouragement—to view from any freeway overpass in Los Angeles the bumper-to-bumper traffic of America on the move—or should I say the arteriosclerosis of U. S. traffic?

V. J. BRAUN, Duarte, Calif.

. . . I WELL remember doing 40 m.p.h. in what seemed to be an uninhabited

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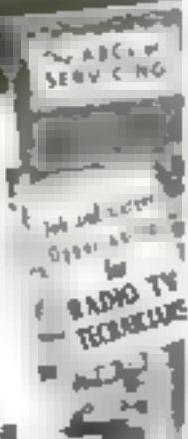
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area when another car passed me at about 70. Just after he passed, he hit and killed a calf. Can anyone see well enough to be a safe driver while traveling at 70 m.p.h.? What about stopping if he can see? The 322 feet he needs is a lot of space.

EDWARD BARNEY, Tucson.

. . . If a car is driven over a bit of glass and a blowout occurs—which is the safest speed, 30 or 60?

If a child or a dog darts in front of a car—will it be more apt to be killed if the car speed is 30 or 60?

If your car tops a rise or rounds a curve and you spot a rock fall or other obstruction—would your brakes stop you quicker at 30 or 60?

MRS. BOB DAVIS, Nashville.

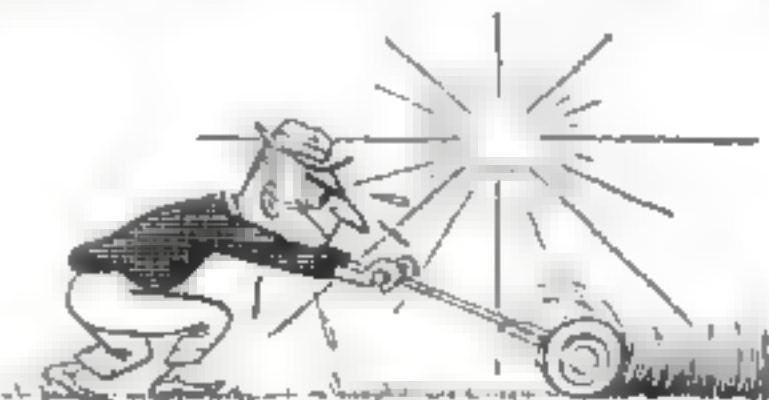
Hinged Ladder Saves Space

The nonslip, hang-up ladder for reaching overhead garage space [May, p. 199] is a fine idea. But with garage walls as crowded as mine, I'd never find wall space to hang it. To solve the problem, I made a short ladder of two-by-fours and one-inch dowel, and hinged it to the lower part of a joist. When not in use, it swings up and hooks to another joist.

F. R. KEITH, Rochester, Mich.

Choosing the Right Grass

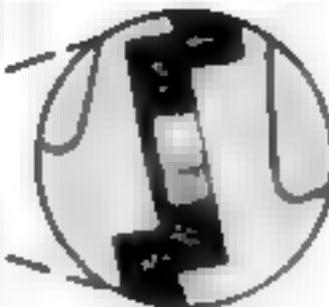
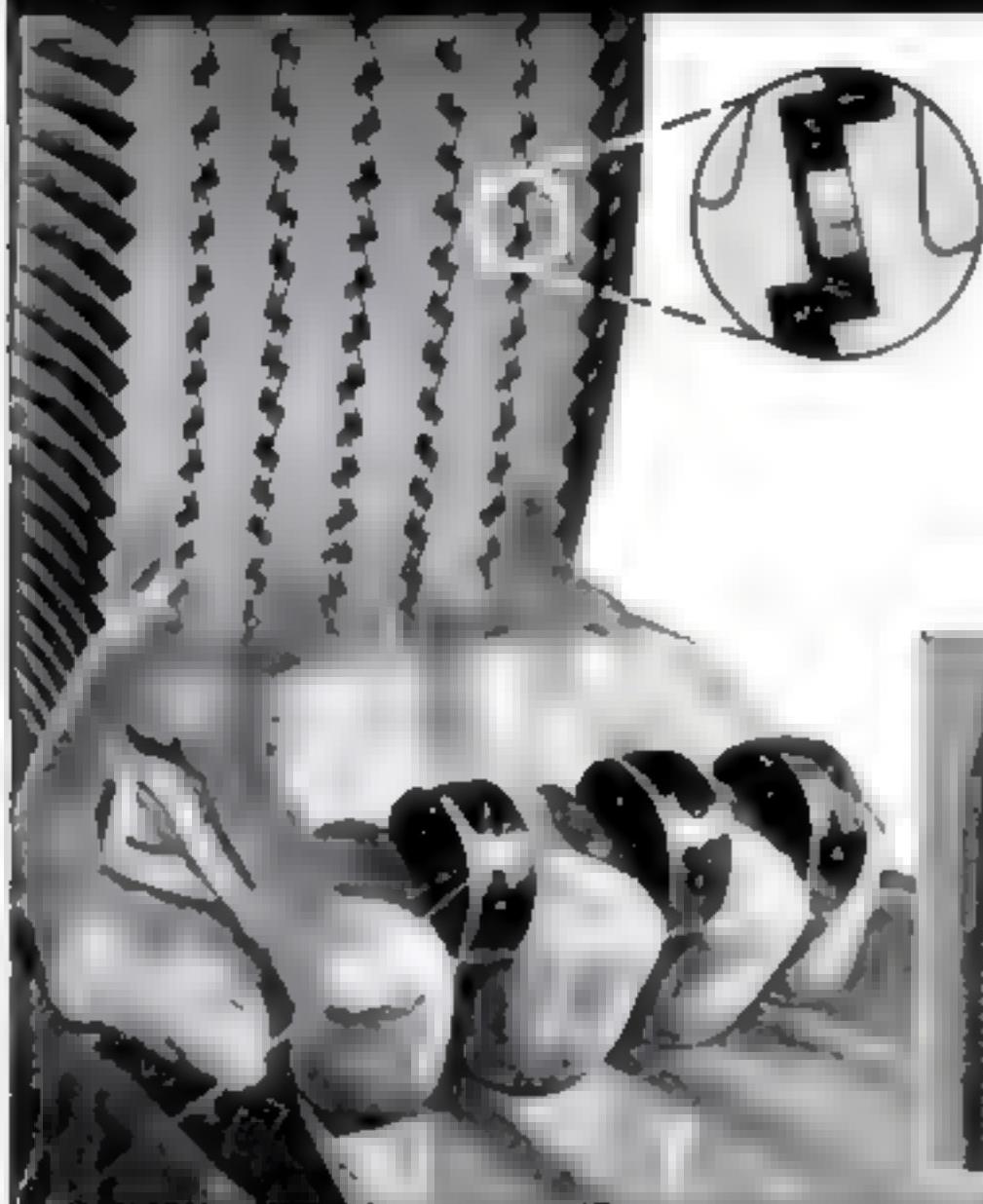
YOUR article on buying grass seed [April] was unfairly prejudiced against ryegrass. Far from being a "trash" seed belonging in a hay field, its purity and germination exceed that of most other



turf seeds. Most ryegrass is sold on a minimum basis of 99% pure seed, 90% germination, and not over 1/2% weeds, far better than the suggested specs.

I agree ryegrass alone is not for a permanent turf, but it is well suited for a number of purposes which the permanent grasses can't fulfill. There is a band some 400-500 miles wide across the

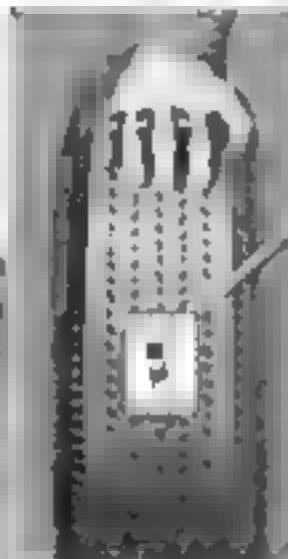
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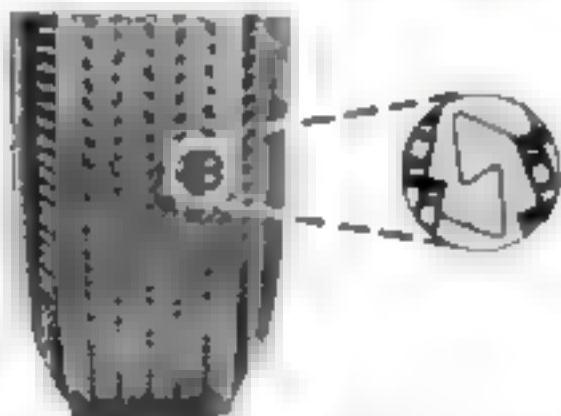
When you hit your brakes, the weight of your car is thrown on the tires. Their tread can be squeezed together into a smooth, slippery surface. To overcome this danger, Armstrong engineers invented the famous Safety Disc tread design, which holds the tread ribs open, always ready to grip the road to stop deadly skids.



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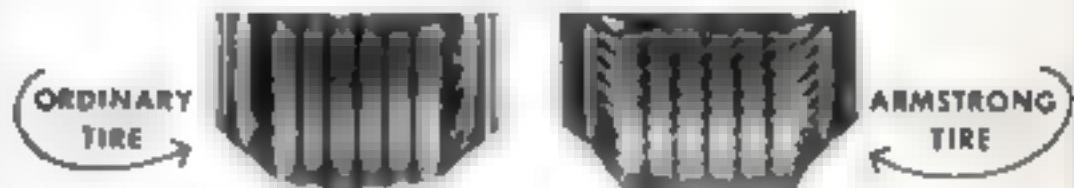
are molded between the tread ribs of the Armstrong tire. Just as the discs in hand at left keep the fingers apart, so Safety Discs keep the tire's gripping edges apart. They can't squeeze smooth, no matter how hard you brake. But the tread of ordinary tires, lacking discs, can squeeze together, go smooth — and you skid!

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Sipes are slots put in tire tread to add gripping edges. Armstrong's S-shape interlocking siping gives sharply improved traction to protect against both forward and side skids.

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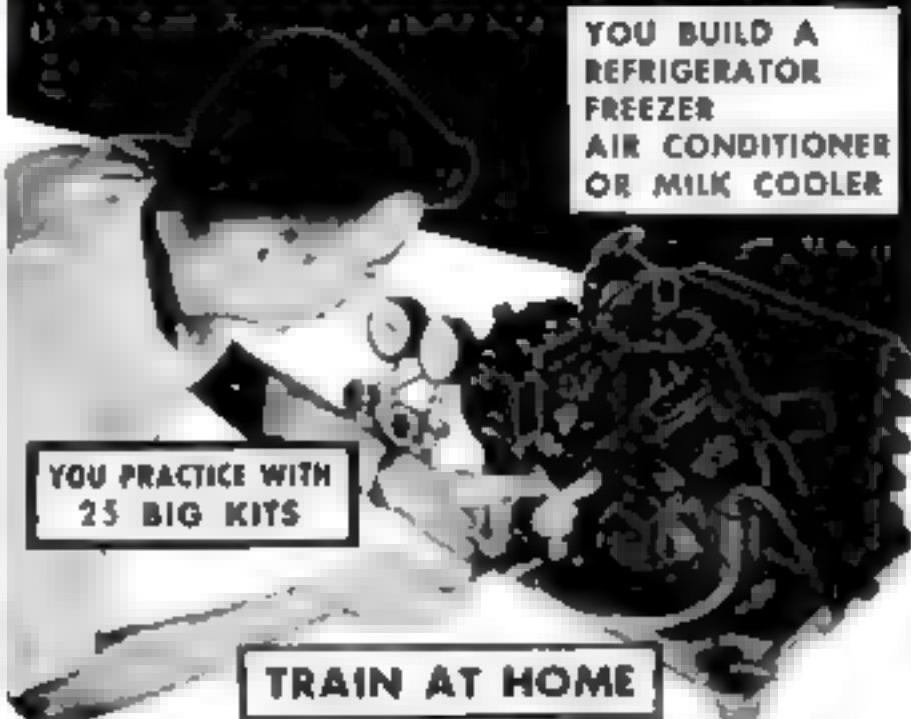
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southern U. S. where ryegrass is used straight to provide a green winter lawn when the permanent turfs go dormant. Broadcast 5-10 lb. per 1,000 sq. ft. in the fall, it gives a fine lawn until summer brings back the permanent grasses. It definitely has a place in the turf-seed category.

C. S. KIZER, Harrisburg, Ore.

The U. S. Department of Agriculture, Rutgers University, and the N. Y. State Agricultural College agree with our statement that temporary grasses should be kept to a minimum in a good seed mixture for a permanent lawn. We do recognize that temporary grasses have their uses—but that is another subject.

Maybe They Forgot to Chirp

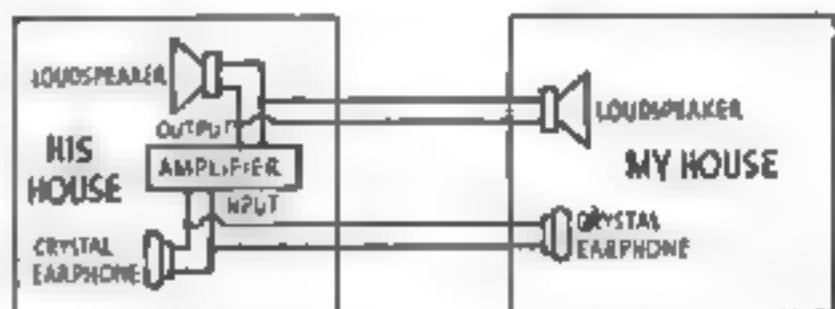
"The Weird and Wonderful Bat" [May] is not always on the beam. A trip to the Carlsbad Caverns in New Mexico will disprove the radar theory. At the entrance of the cave there is a string of spaced wires. When the bats come out in the evening, they must pass through these wires and many fall into the net.

J. YONKERS, Belmont, Calif.

Private Phone System

MY PAL AND I wanted to communicate between our two houses. We rounded up two crystal earphones, two batteries, and two 100-yard pieces of wire. After we hooked it up, we could hear and speak over the earphones clearly, with or without the batteries.

Then my friend's big brother gave us an old tape recorder. We strung two more lines, tapped the amplifier of the tape recorder and rigged up loudspeakers.

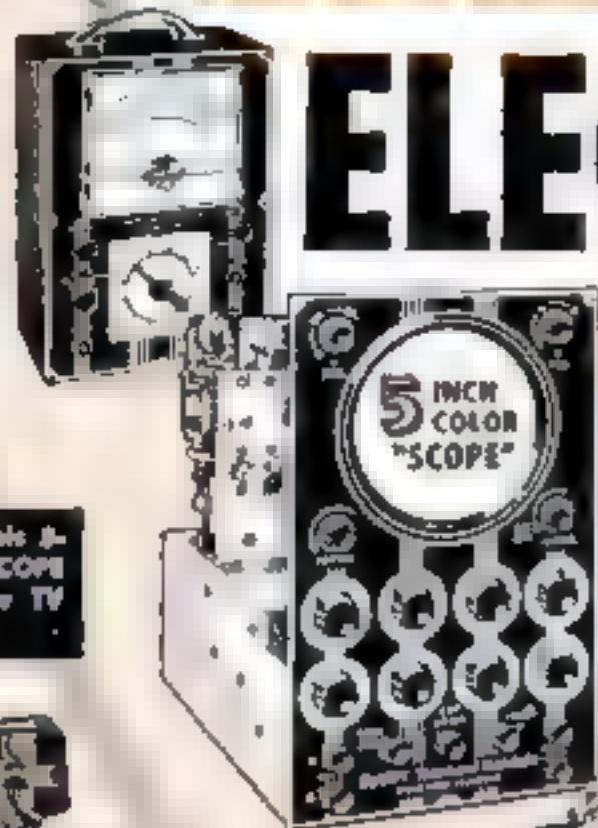


Now we have loudspeakers to listen through and crystal earphones to talk through. Whenever my friend wants to call me, he turns up the amplifier until there is a loud backsqueal. The system works so well we just had to tell somebody about it.

RICHARD TANNEHILL, Tucson.



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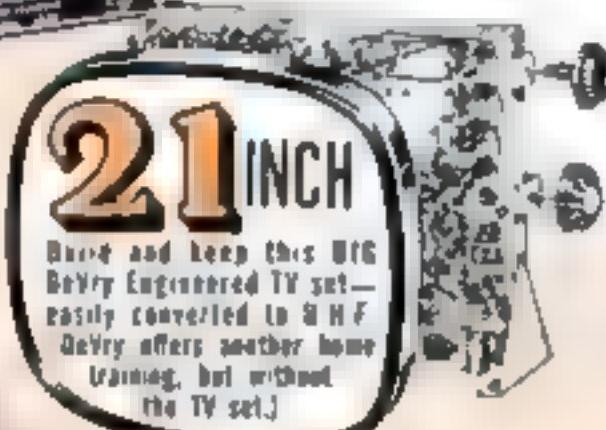


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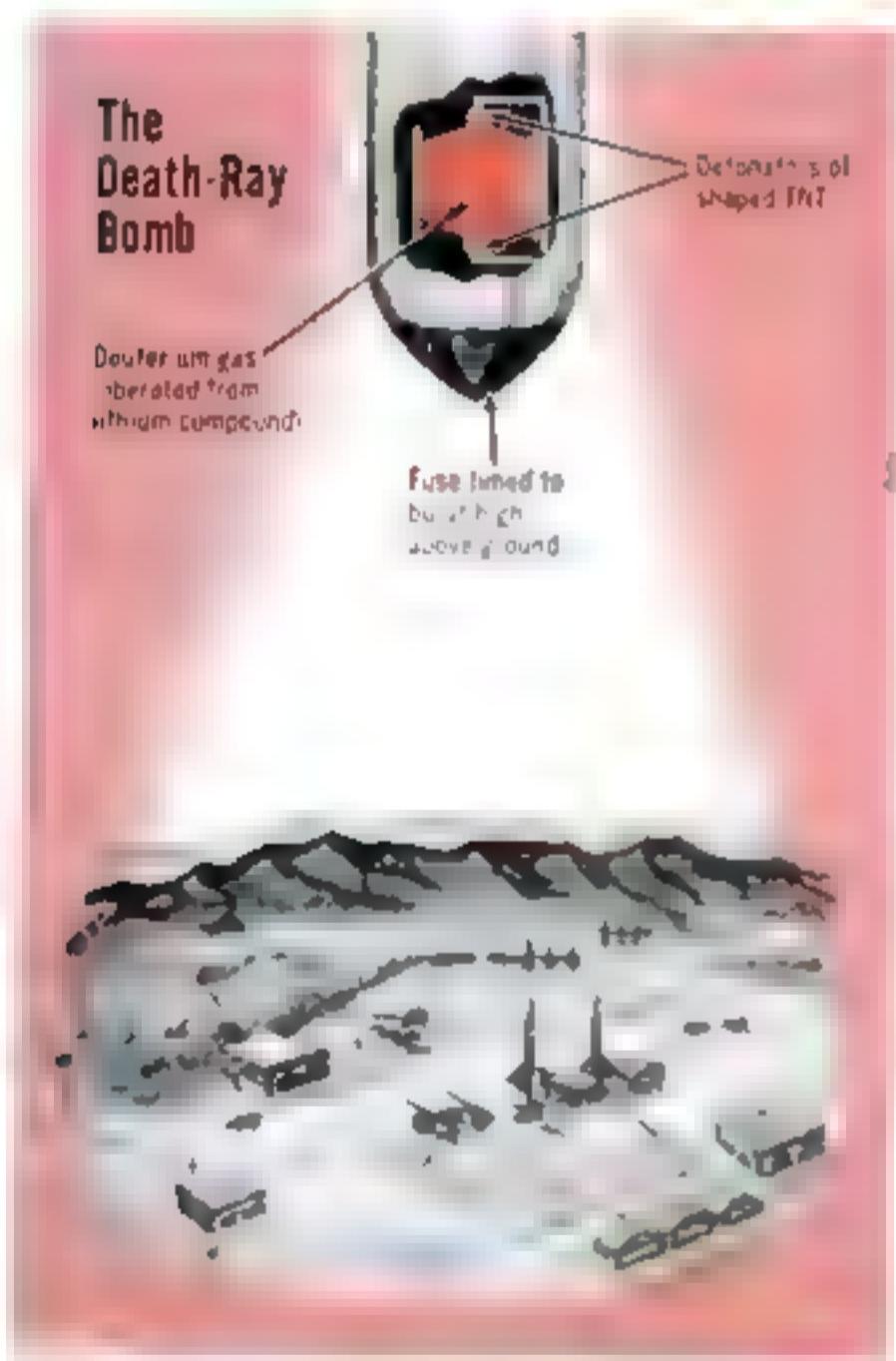
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The month in science

Death-ray bomb. Are the U.S. and Russia readying a new and terrible "neutron-ray" weapon? This possibility is raised by opponents of an international agreement to stop testing A- and H-bombs. They fear that the neutron bomb could be perfected secretly, despite such an agreement.

The weapon causing the hullabaloo is a real Buck Rogers job: a true death ray. It would make hardly any bang, cause no damage to buildings or machines, create no radioactive fallout—but it would kill every person outdoors and indoors over a wide area, not instantly, but certainly. It could wipe out a whole tank regiment with one blow, yet leave their equipment ready for use. An invader could depopulate a city, and quickly move his own men in to factories, docks, buildings.



Officials in the know are, understandably, silent. Yet a quick riffle through the published books on nuclear weapons indicates that the neutron bomb could be made. And that means we're working on it, and they are, too.

The death ray would be a stream of neutrons. Unlike the other two components of atoms (electrons and protons), neutrons carry no net electrical charge. They are neither repelled nor attracted by electrons and protons, so they slip easily past and through atoms. They go right on through wood, metal, and air for long distances. Shielding (for shelters) must be thick and heavy.

The only thing that stops a neutron is a head-on collision with the core of an atom. Then the neutron gives its momentum to the atomic core, sending it flying away. This is what happens when a stream of neutrons hits a man. Some of the neutrons knock loose atomic cores (usually

of hydrogen and nitrogen), destroying bodily processes. The victim won't see or hear anything, and he won't feel any pain unless it's a very heavy blast. (Then he'll feel as if he's burning up.) Even a painless dose can make a man pass out after a short time, and die within a week or so. Military tacticians will have to cope with one strange fact: Neutrons will not put a man out of action immediately; he could continue to fight back for a while after the death ray had doomed him.

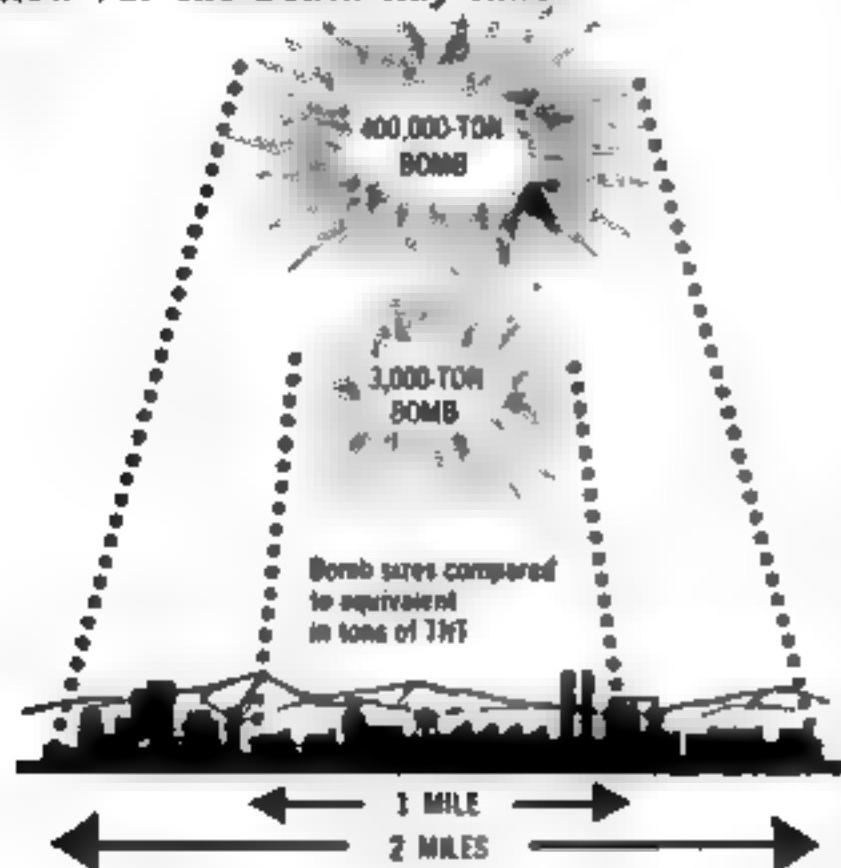
The neatest way to generate neutrons is with an H-bomb. It

The month in science continued

releases no radioactive glop to contaminate earth and atmosphere. H-bombs can be made small, right down to firecracker-size. All you need is deuterium or tritium gas (refined from water), and something to heat the gas to a temperature of several million degrees. The standard heater-detonator has been an A-bomb. This doesn't seem suited for the neutron death ray—A-bombs must be bigger than a certain minimum, and they make

a lot of nasty radioactivity. But there have been attempts to set off the H-reaction with shaped charges of TNT. The neutron death ray could be a bangless H-bomb—small, detonated by TNT, and cleverly designed to release heat energy meagerly and slowly while flinging out uncountable numbers of neutrons. It would be fused to burst fairly high above ground, so that the rays shine down, unobstructed by hills and heavy buildings. If its explosive force were equivalent to that of a mere ton of TNT, it would make a ball of fire brighter than the sun and 74 feet across. Assuming it could generate as many neutrons as the original A-bomb used on Hiroshima—a very modest assumption—these rays of death would kill people a half-mile away. There would be no time to dive for shelter. It would all be over in one second.

How Far the Death Ray Kills



est assumption—these rays of death would kill people a half-mile away. There would be no time to dive for shelter. It would all be over in one second.

Instant pictures. A Westinghouse researcher named J. Nicholson has gone the picture-in-a-minute camera one better. He has invented a TV camera-tube material that lets you make pictures instantaneously. You get an all-electronic still picture on a standard TV viewing screen—without waiting (not even a second) for any processing. The picture stays 5 to 10 minutes unless erased.

The new Permachon tube is already being used to snap the display on the scope of a weather radar for transmission over television. But it can do a lot of other jobs that are now impossible.

- Shoot the license number of an auto speeding through a radar trap, relaying the image to a monitor in the cops' catch car ahead.
- Read freight-car numbers off moving trains.
- Make instantaneous photofinish pictures to settle close horse races.
- Inspect factory products as they go past on a fast-moving conveyor, even comparing them to a master outline gauge.

To make instant pictures, you need a TV camera and receiver, standard except for the Permachon camera tube. Its surface changes electrical resistance when struck by light, and unlike others, retains this resistance pattern through repeated scanning by the electron beam that generates the picture signal.



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WHENCE came the knowledge that built the Pyramids and the mighty Temples of the Pharaohs? Civilization began in the Nile Valley centuries ago. Where did its first builders acquire their astounding wisdom that started man on his upward climb? Beginning with naught they overcame nature's forces and gave the world its first sciences and arts. Did their knowledge come from a race now submerged beneath the sea, or were they touched with Infinite inspiration? From what concealed source came the wisdom that produced such characters as Amenhotep IV, Leonardo da Vinci, Isaac Newton, and a host of others?

Today it is known that they discovered and learned to interpret certain Secret Methods for the development of their inner power of mind. They learned to command the inner forces within their own beings, and to master life. This secret art of living has been preserved and handed down throughout the ages. Today it is extended to those who dare to use its profound principles to meet and solve the problems of life in these complex times.

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PS Puzzlers

By Joan Steen

Where riddlers meet to compete . . . Answers on page 199



CHESTER BENNIA

The day the bank teller goofed

IT'S conceivable that a teller could make a mistake in your favor, but sadly it's rare outside Puzzledom.

A man went into a bank to cash a check. The clerk muddled the amount, however, reversing the dollars and cents figures. (Had the check read \$37.51 the clerk would have handed the man \$51.37.) After the man left the bank he bought a

shirt for \$3.50. He counted the money he had left and discovered he had just twice as much as the amount on the original check. What was it?

You can solve this by trial and error. If you use x's and y's you may be stymied by what appears to be an unsolvable equation. But it's not, if you stop and think about the numbers involved.

Can you spot the fallacy in this tale of too many travelers?

At a humble inn where there were only six rooms, seven travelers applied for lodgings, each insisting on having a room to himself. Completely undaunted, the landlord put the first man in room No. 1 and asked one of the other men to stay

there also for a few minutes. He then put the third man in Room No. 2, the fourth man in room No. 3, the fifth man in room No. 4, and the sixth man in room No. 5. Then, returning to room No. 1, the landlord took the seventh man and put him in room No. 6. Thus each man had his own room!



SIMEON POISSON, the great French mathematician of the nineteenth century, might never have chosen his career had it not been for a puzzle. Poisson's family, according to his biographer, had

FROM the mysterious East comes this two-fold mechanical problem for you. Suspended inside from the roof of a tall, slender pagoda in Japan there is a long wooden rod with a heavy ball at its end. The rod serves no decorative or religious purpose but is a safeguard. Now, the question: What does the rod prevent and how does it work?

tried to steer him into a variety of professions: medicine, law, etc., all in vain. Then one day on a journey a friend posed a problem very similar to this one. Poisson saw he could solve the puzzle im-

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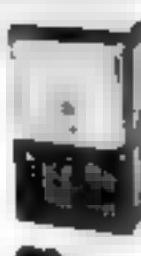
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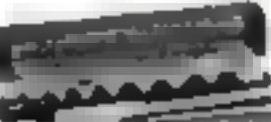
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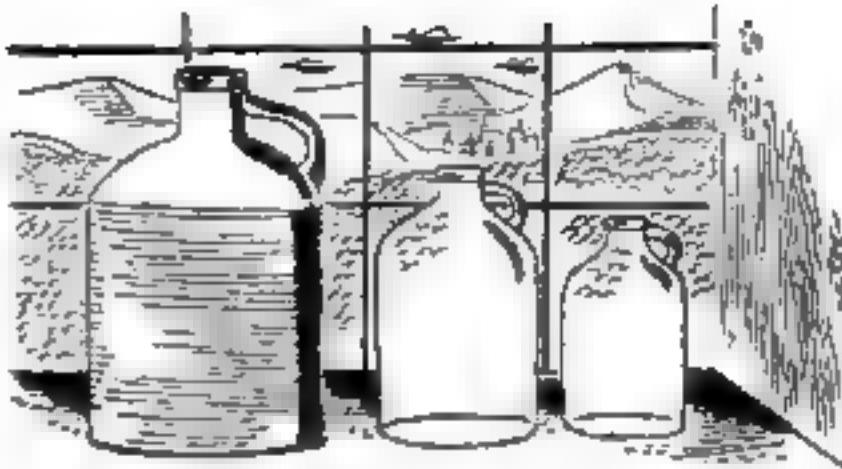
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PS Puzzlers continued

mediately, and realized his true calling.

Two friends bought an eight-quart container of wine. They wanted to share it equally but they discovered they had only two flasks: one five-quart, one three-quart. How did they manage an equal division? Can it be done in fewer than seven steps?



"BEAUTIFUL maiden with beaming eyes, tell me . . ." begins an ancient Hindu problem in mathematics. Pleased that the Hindus so esteemed women, I read on, delighted by the writer's style

Here's the problem. You can solve it algebraically, but you'll find it easier to use reasoned guesswork instead. (The Hindus knew about zero and infinity, but they stuck to small whole numbers in most problems.)

"The square root of half the number of bees in a swarm has flown out upon a jessamine bush. One female flies about a male that is buzzing within a lotus flower where he was lured in the night by its sweet odor, but is now imprisoned. Eight ninths of the whole swarm has remained behind. Tell me, dear maiden, the total number of bees."

Puzzle of the month



TO THE Orient again, this time for the Tower of Brahma. This is actually a puzzle you can build and play with, but naturally it too comes veiled in Eastern legend:

In a great temple at Benares there is a brass plate in which are fixed three diamond needles. On one of these needles at creation Brahma placed 64 disks of pure gold—the largest disk at the bottom and the others getting smaller and smaller up to the top one.

Answer to last month's P.O.T.M. Remember the game of Nim? You have 21 matches and you and your opponent must pick up at least 1 and no more than 5 at a turn. You want to stick him with the last match and you start. Here's what you do. Mentally divide the total number of matches into groups such that the last group contains just 1 match, and the middle groups all have 1 more than the maxi-

This is the Tower of Brahma. Day and night the priests transfer the disks from needle to needle obeying these immutable laws:

One and only one disk can be removed at a time, and never can a larger disk be placed on top of a smaller one. When the 64 disks shall have been transferred to another needle, tower, temple, and Brahmans alike will crumble into dust, and with a thunderclap the world will vanish.

Can you bring their world to an end? Don't start trying to find how many transfers it would take to remove all 64 disks. Work the problem first with two, then three, four, or five disks—and devise the general rule. (Answer next month.)

mum you're allowed to pick up. Then see what's left for the first group. In this way you get a sequence: 2, 6, 6, 6, 1. Pick up 2 matches to start. Then whatever your opponent picks up at his turn, pick up the difference between that and 6. (He picks 1, you pick 5, etc.) In this way you'll always be filling out the groups of 6 until there are no more. It'll be his turn when you reach the last match.

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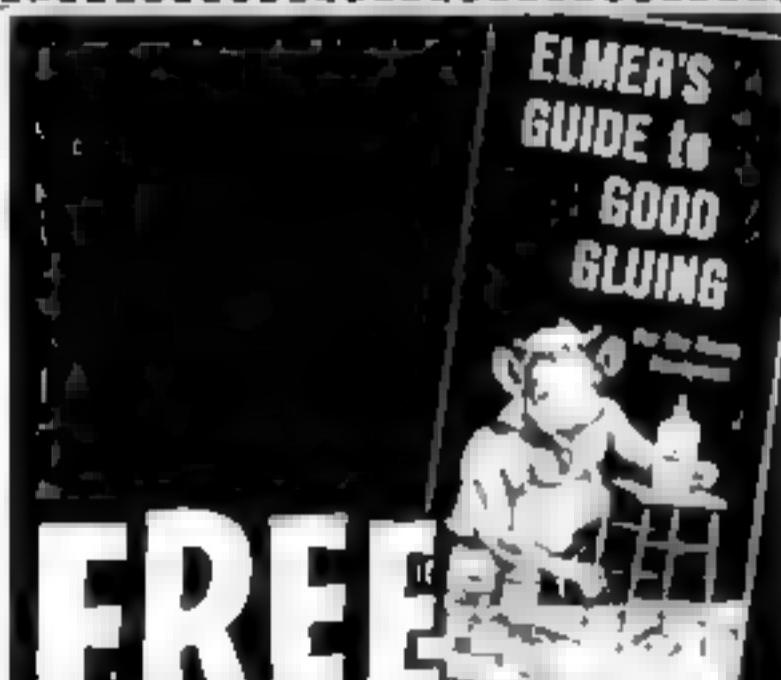
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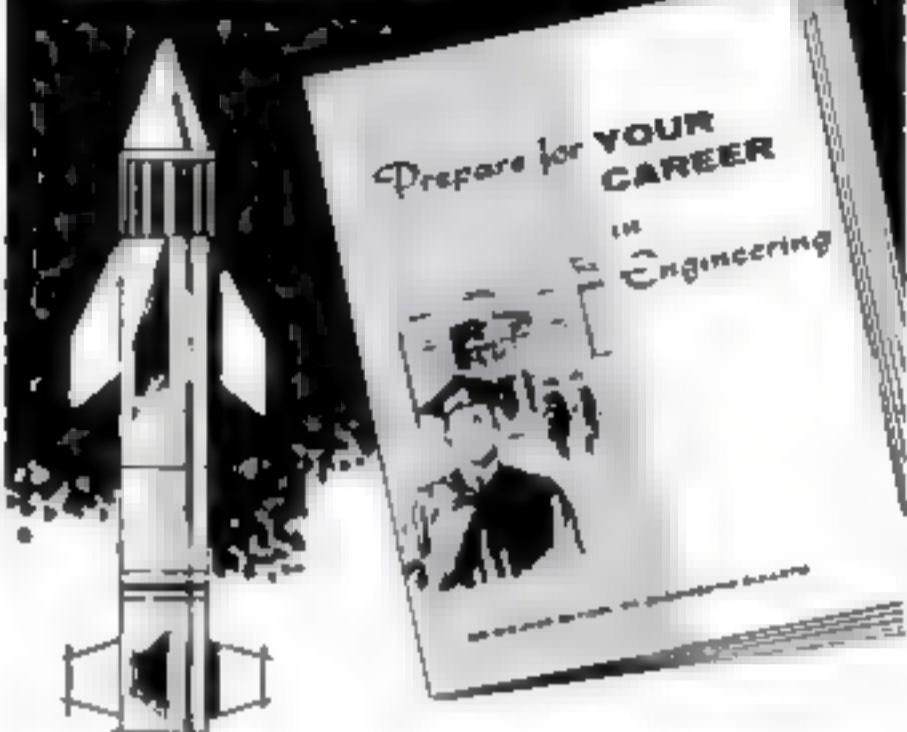
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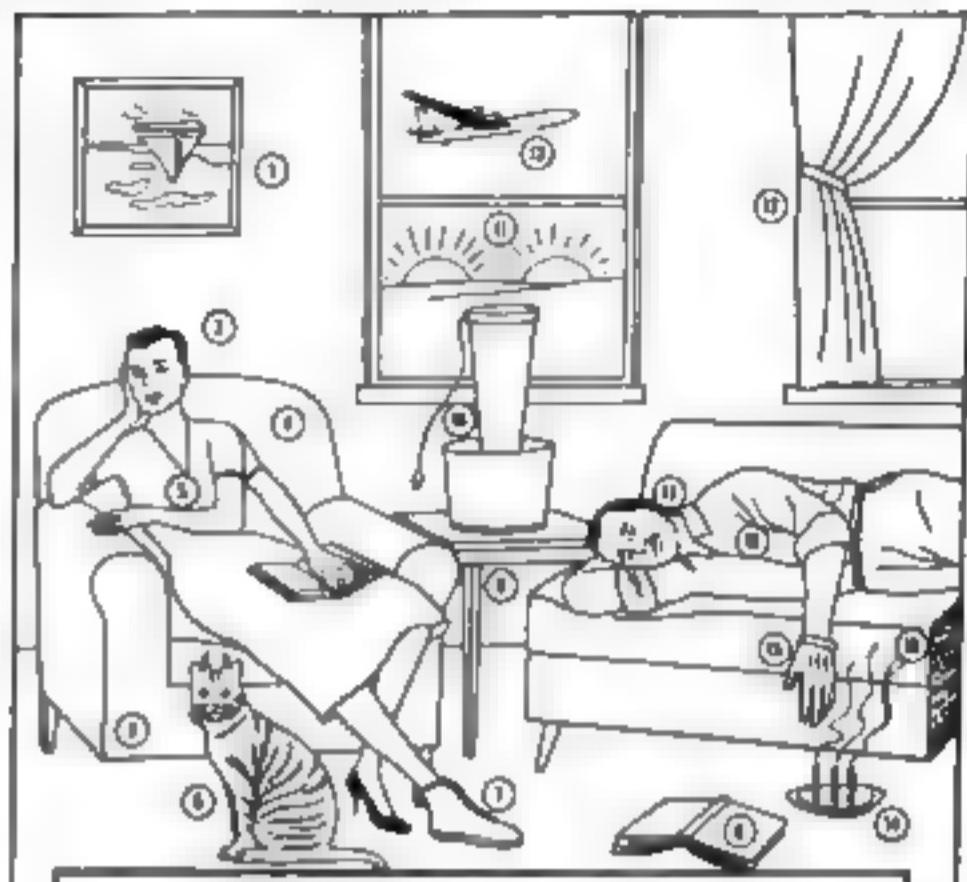
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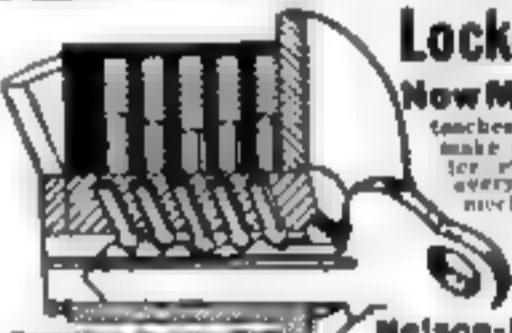
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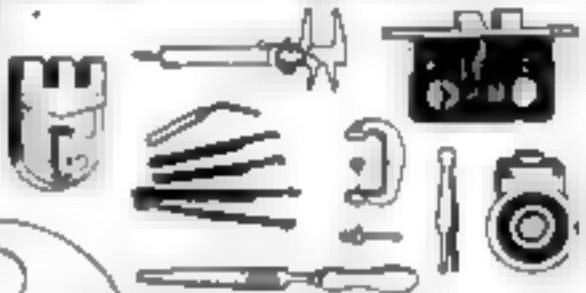
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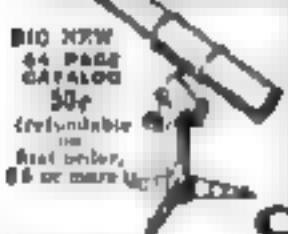
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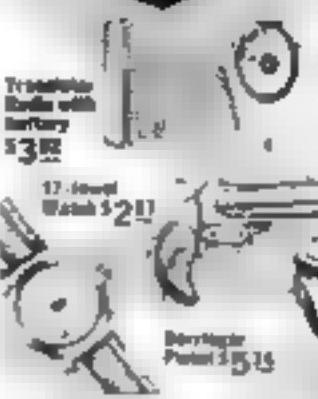
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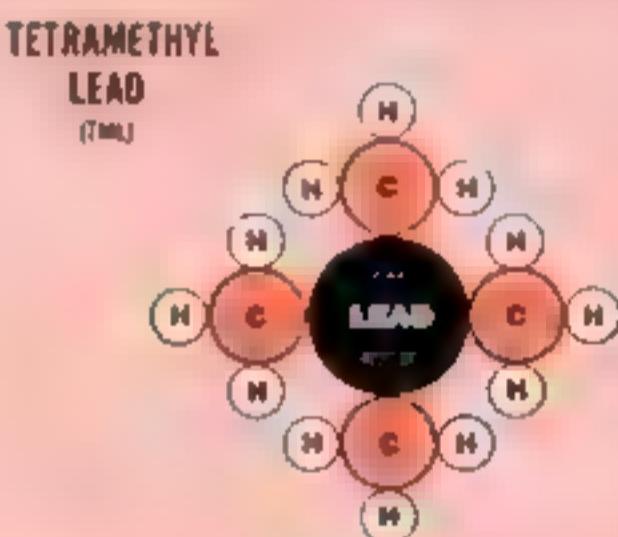
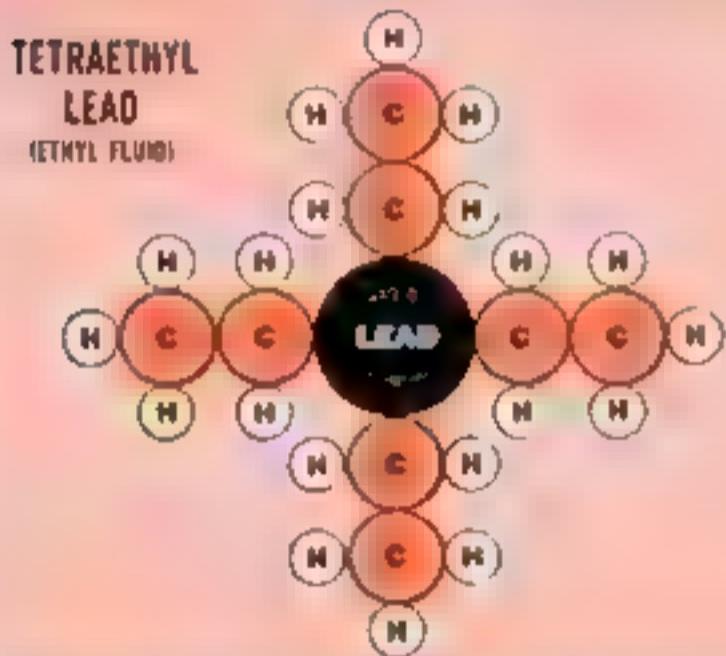
Tiny U.S. Cars Look Likely

OFFICIALS at Chevy and Chrysler both deny interest in domestic VW-size cars, but behind-the-scenes activity indicates they are looking hard at under-100-inch wheelbase jobs.

This is nothing new. Both companies have periodically instituted design projects involving cars smaller than current compacts—on a "just-in-case" basis. With

Ford apparently committed to building such a vehicle, its competitors are taking their projects off the shelves and going to work on them in earnest.

Today's changing market, indicated by the success of the compacts, has old ideas flying out factory windows like flocks of pigeons—and American VWs look like a better bet for the future all the time.



Tetramethyl lead for gasoline. A compound that has been lying around the labs for years now looks like the best hopper-upper for fuel for smaller cars. It is tetramethyl lead—a lead atom bonded to four methyl (CH_3) groups. It sounds almost the same as and is very similar to the standard antiknock fluid, tetraethyl lead—four ethyl (C_2H_5) groups.

The methyl compound, called TML,

turns out to be an especially effective preventive of misfires that result when fuel separates (in the manifold) into light and heavy portions. This fuel-segregation knock is common in manual-transmission cars, and such cars would benefit most from TML-spiked gas. For them, TML boosts octane ratings two to six numbers higher than the same amount of tetraethyl lead.

Real "life-of-car" mufflers? A new ceramic-coated exhaust system American Motors plans to introduce on all of its 1961 models "should largely eliminate the need for exhaust-system replacement in normal car life," the company says.

Tests made over a three-year period show the ceramic coating to be resistant to emission acids, rust, and salt—the

main causes of muffler and tailpipe corrosion.

The ceramic is applied by a process originally developed for military jet engines.

The mufflers and tailpipes are dipped, so both outer and inner surfaces are coated. (This is important, since acids and water collecting inside mufflers eat



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DETROIT REPORT continued

through metal rapidly.) Parts are then baked in furnaces at 1,500 degrees to fuse the coating to the metal permanently. Finally, a layer of asbestos and a zinc-coated, corrosion-resistant outer cover are wrapped around the mufflers.

A special muffler design—the result of 5,000 experimental mufflers—insures proper flow and the efficient coating of the

liquid ceramic on inner baffles and tubes.

Other auto companies haven't yet reported plans to introduce the more expensive ceramic-coated mufflers. But if they prove as durable as claimed, it is inevitable.

Their use could mean a big shrinkage in the muffler-replacement business within three or four years.

New small V-type engine? Reports from Dearborn indicate that Ford engineers are developing a series of small-displacement V engines designed to power compact (and tinier) automobiles.

Baby of the family is a little 104-cu.-in. V-4 destined for the Anglia-size, front-wheel-drive car that, rumors say, Ford will market early in 1961. This engine is water-cooled, but was designed originally without a fan. It overheated in tests, so various means of additional cooling are being tried.

Engineers added a thermostatically controlled electric fan. This works, but it's expensive and drains a lot of electrical current.

Next engineers designed a longer cam-shaft that projects through the front of the block—and mounted a fan on its end. This is now under test.

A V-6 and a V-8 make up the rest of

Ford's new small-engine family. The V-6 is the same size inside as the current Falcon and Comet in-line six: 144 cu. in. The V-8 is somewhat bigger, about 170 cu. in.

A unique valve-actuating system used in each of the three small engines maintains zero backlash without expensive, finicky hydraulic valve lifters. Valve rocker arms ride on cam-shaped devices which are lightly spring-loaded to compensate for wear, thus eliminating the need for periodic adjustments. (According to some reports, Ford plans to use this system on its bigger V-8, too; possibly as early as this fall, when 1961 models appear.)

An educated guess is that there will be a good deal of parts interchangeability among the V-4, V-6, and small V-8, and that much of the tooling will serve for all three engines.

Corvair to drop gas heater. Chevrolet will eliminate one of the Corvair's least popular features, the gas heater. In its place, they'll use hot engine oil to warm passenger compartments of 1961 Corvairs. Heat will be tapped from an oil intercooler and routed inside the car.

The new heater won't provide heat as fast as the gas heater did. But it will heat up as rapidly as a hot-water heater—and, come winter, it won't steal fuel, which can be better used to make the car travel a few miles farther on a gallon of gas.

Fuel injection not dead yet. A new fuel-injection system developed by an independent consulting engineer just might provide the spark needed to arouse fuel injection from its present semicomatose state.

Injection-molded plastic parts, which can be produced cheaply and easily, make up more than 80 percent of it. Costs reportedly are in line with those

of comparable carburetion systems—and fuel economy is said to be excellent.

The furor over automobile smog control might help revive fuel-injection interest, too.

An efficient, well-designed injection system shuts off fuel flow during deceleration, so less unburned hydrocarbons are spewed into the atmosphere than with conventional carburetors.

TRIPLE EXPOSURE at 1/11 is how our Speed Graphic caught this fellow flexing his muscles. Just try this exercise yourself. See how fast you tire out. When you do, remember that tires do 700 "push-ups" per mile as they roll along under your car.



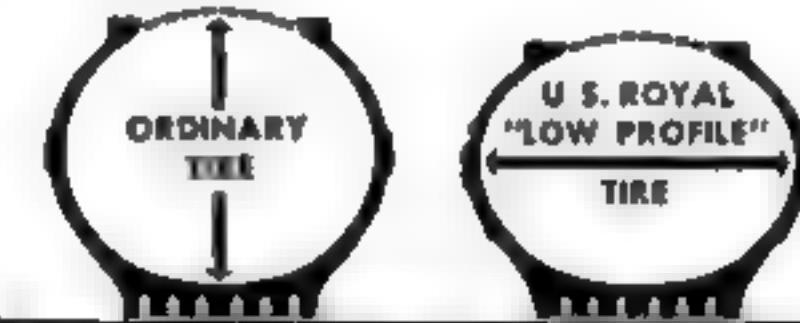
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New *Low Profile** tire is actually
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Excessive flexing is what wears out, burns out
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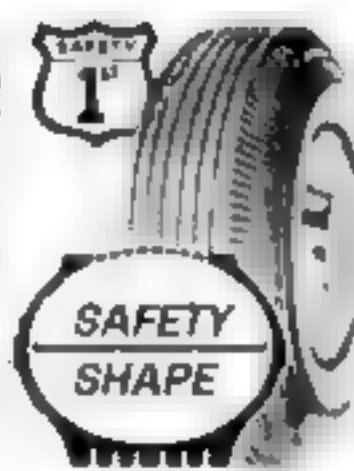
Other tire designs don't give such thorough
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Excessive flexing pushes the
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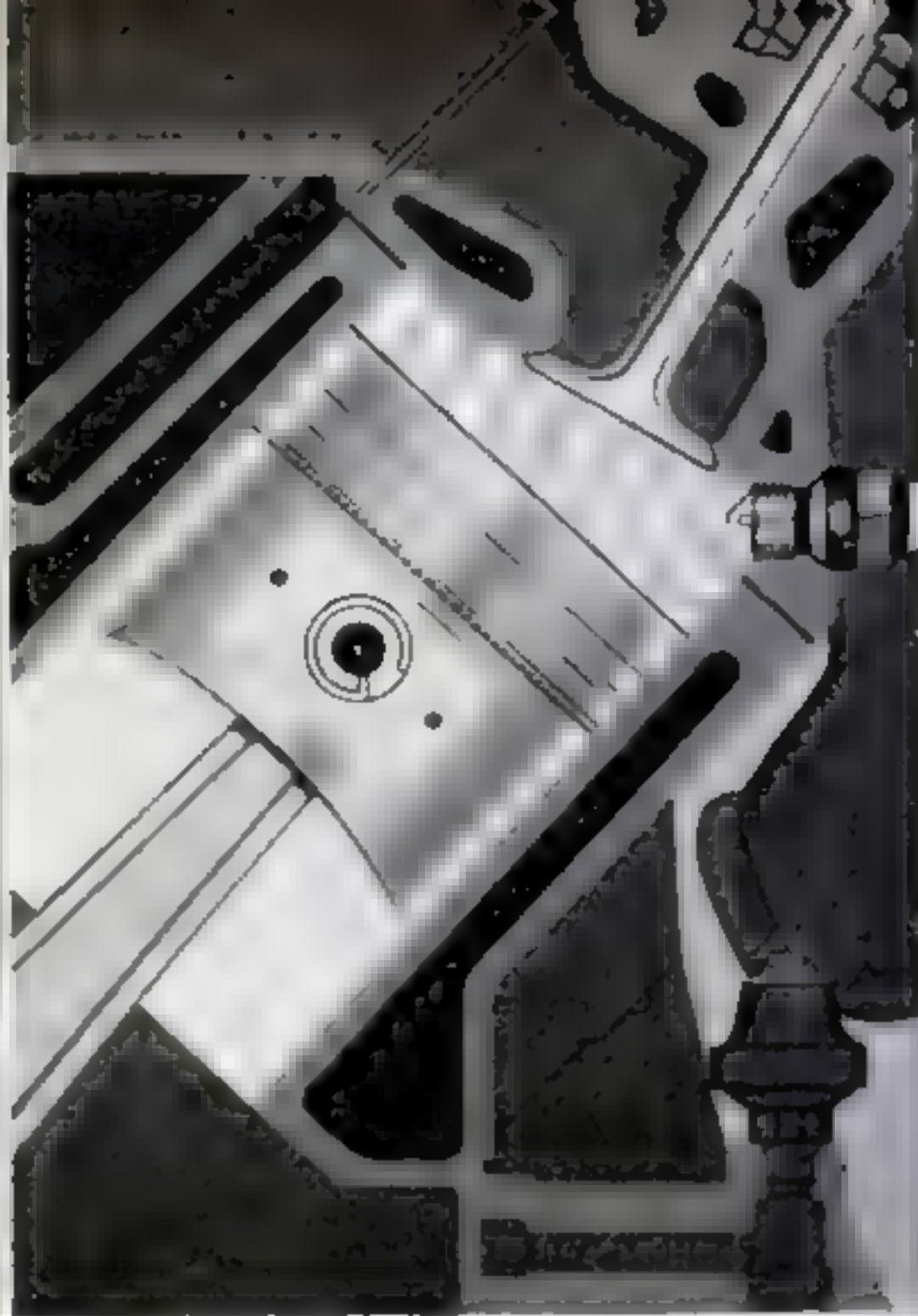
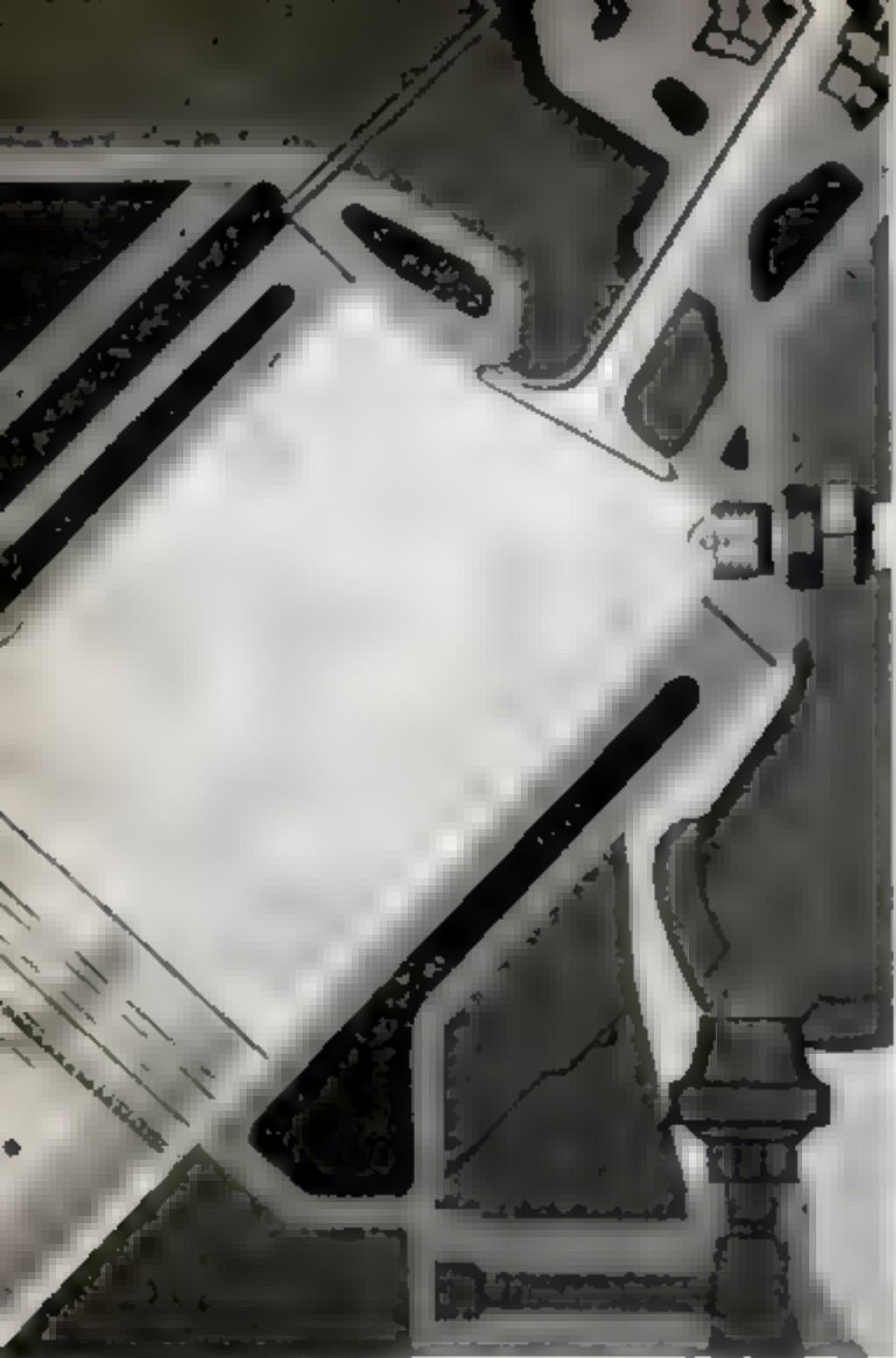
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The space occupied after explosion (left) is 9 times what it was before explosion (right). Therefore, the compression ratio is 9 to 1.

What compression ratio really means

Compression ratio is the ratio between the amount of space which gases occupy after explosion (left), and before explosion (right).

Here's what happens during the four-stroke compression cycle used in most passenger car engines. First, the piston in the cylinder goes down as the intake valve opens. This lets the vaporized gasoline-and-air mixture enter the cylinder. Second, the piston rises to its end position, squeezing the mixture together (compression).

Third, the spark plug ignites the mixture, causing an explosion that forces the piston down on its power stroke, which turns the crankshaft. And fourth, the piston again rises as the exhaust valve opens, pushing the burned gases out of the cylinder (exhaust).

To keep all the power built into your engine, use this combination of Texaco products: Sky Chief Su-preme gasoline in the tank, and new Havoline Special 10W-30 motor oil in the crankcase. Here's why:

Sky Chief Su-preme has a special petroleum base additive called Petrox that gives you unusual upper-cylinder protection other gasolines don't offer. And new Havoline Special 10W-30 protects moving parts in summer heat and freezing cold as no ordinary motor oil can do. You use the same grade in all seasons...but it should be changed *regularly*.

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TUNE IN: TEXACO HUNTLEY-BRINKLEY REPORT / MONDAY THROUGH FRIDAY / NBC-TV



A trap for the unwary: unlighted, slow-moving farm equipment, going back home at dusk.

Tricks for 'em Two-Lane

High-mileage experts reveal how they guard against the perils of these "killer roads"

YOU bet your life, statistically speaking, every time you turn on the ignition key. So it makes excellent sense to look at the odds.

• More than four out of every five highway deaths result from accidents on two-lane roads.

- The risk of a fatal accident is almost six times greater on a common, everyday two-lane road than it is on a high-speed superhighway.

- Worse, the exposure is inevitable. There are about 7,000 miles of superhighway in the U. S., compared with more than 3,000,000 miles of two-lane roads.

What makes 'em bad? The two-lane road is dangerous because it is unforgiving. There's simply not enough room to



TWO HIDDEN CARS are approaching this intersection. The oncoming car, just climbing the

permit lapses in perception or judgment.

Suppose you're driving on a dry, straight, smooth road. You're going 60 m.p.h., and another car is approaching you at the same speed. If the road is 18 feet wide—a very common two-lane width some years back and still often found—you and the other driver must perform a remarkable feat. You must guide two 80-inch-wide cars past each other, keeping right wheels within a foot or two of, but not over, the dangerous shoulder. At the same time you and he must divide up the 18-to-24-inch clearance space between the two cars. You must make this division while the cars are closing at the rate of 176 feet per second. Which means that one instant the cars are more than half a football field apart and one second later they have passed each other.

Two-lane roads are murderous in other ways. They bend, climb, and de-

rise, is masked by a billboard from the second car that is entering the crossing from right.

scend much more than do wider and more decorous highways. This means that they are booby-trapped with reduced sight distances and increased stopping distances. They are comparatively hard to pass on, and the botched pass is a major cause of accidents. They are studded with unpredictable obstacles like livestock and farm machinery. Literally millions of driveways, side roads, and grade crossings intersect them. And they are highly likely to choke down to narrow bridges—many of which, apparently with hostile intent, are angled differently from the roads they serve. (The hostility is unintentional: The shortest, cheapest bridge has always been a minimum-width one that crosses a stream at right angles, not diagonally as a road may do. Perhaps this made sense 40 years ago—but highway engineers now know that economy like this kills people.)



IF YOU CONCENTRATE on an oncoming car, you may ignore something crucial. Here three other



cars are threatening to make a problem. The third? It's nosing out between shed and silo.



CLASSIC CURVE CRISIS is the threatened side-swipe when one car drifts out of its lane. With

Expert over-the-road drivers use many special techniques to cope with these dangerous roads. Some are habits and tricks that almost all good drivers use; others are subtle and ingenious. Here are excerpts from interviews with a number of high-mileage drivers:

"I always stay over on my side of the road, of course, but after dark, when conditions permit, I keep the left wheels tracking near the centerline. The reason: It's then that pedestrians and unlighted farm wagons are the big hazard, and being just a couple of feet over makes dodging them a lot surer."

"On unfamiliar two-lane roads, curves can mousetrap you badly. On high-crowned roads I slow down a little more for a curve to the left than for one to the right, because there the surface is banked the wrong way."

Wariness about others was a note men-

shortened sight distances in most curves, such situations can develop in a split second.

tioned by another high-mileage pro, this one a man who has wheeled a truck over many a narrow road. Said he:

"I don't have faith in the other guy. I figure he can be a nut or a drunk. So when I see a long line of cars coming toward me, backed up behind a slowpoke, I get set for a dimwit to pull out into my lane. (Often he'll be tempted into it on a slight curve, when he can see ahead just a little.) Whenever I spot a procession like that, I slow down and get ready for the ditch."

"**Hariest setup** on narrow roads is when an oncoming car starts weaving over toward your side. Usually he's just careless—but he could be sick or drunk or crazy. I don't wait even a second to see if he's going to pull back. I get on the brakes and horn as quick as I can."

"I've learned to watch driveways from barns and farmyards. Maybe it's the



PROBLEM COMING UP: The cows, barely visible to the oncoming car, may insist bovinely on

their right of way. And its horn or screech of brakes may scare them into your path. Go slow.



EVEN THE EASY PASS demands care. Here a car is wisely lying well back before passing, to get good visibility around a bulky truck.

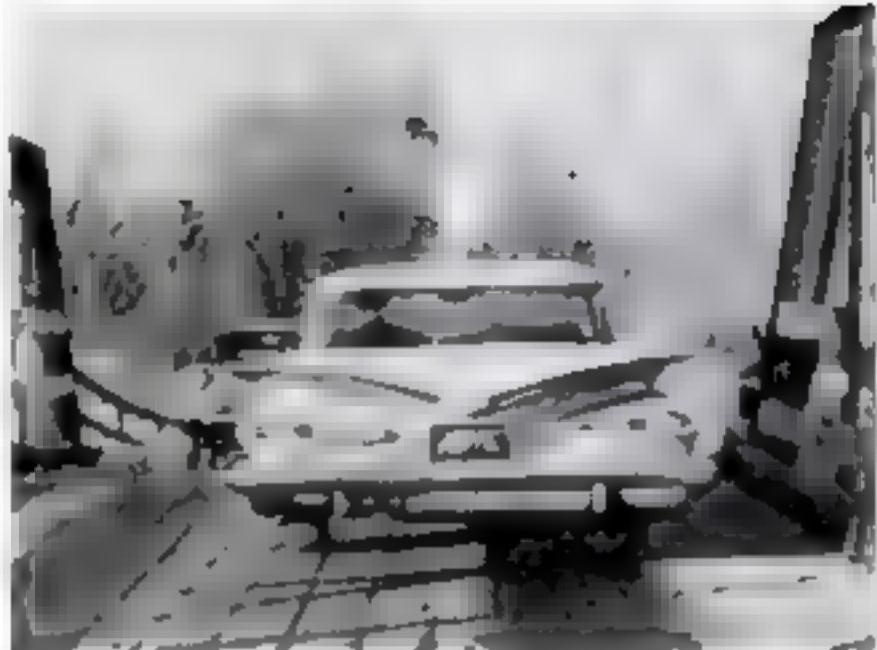
tractor noise, but there are plenty of farmers who won't hesitate to pull right out onto the highway without looking.

"You're nibbling on the cheese if you depend on road signs to warn you of sharp turns or narrow bridges. Many two-lane roads are badly marked. And signs get knocked over. Or brush can grow up. On a road I don't know, I simply don't count on being warned by signs."

A driver whose idea of fun is to make a five-day transcontinental trip says:

"I put no stock in those broken lines that are supposed to tell you when to pass and when not to. Mostly they're all right, but on a strange road at night they can be tricky. I've seen them carried deep into blind curves or up near the crest of a hogback."

"After dark I navigate in part by the other fellow's headlights. As soon as a new set comes over the horizon, I put them on a sort of mental radar screen.



BRIDGE MEETS can be bad business unless you're ready to stop quick. You just have to wait out the wide, or widely driven, oncoming car.

I try to keep track of them, only canceling them when they flash past. They tell me how the road curves, and whether there are dips or hills ahead. Often they'll silhouette some unlighted wagon on my side of the road. I have an unholy horror of the one-eyed light, and abide in my lane until it's by."

A man whose job sometimes involves driving thousands of miles a week had this to say:

"When I'm making a long haul where fatigue is the biggest problem, I've found it's restful to keep my speed pretty close to the general flow of traffic, and pass only the real slowpokes. The trick in making good point-to-point time isn't speeding; it's in not dawdling. If a driver wants to pass me, I never challenge him, so long as the road ahead is clear. It just shows that he's a brisker over-the-roader than I am, not that he's a better guy."

[Continued on page 182]

How Wide Is a Car —and a Two-Lane Road?

AUTOMOBILES have been steadily growing wider as well as longer. Present U.S. cars range from 72 to 81 inches wide. The commonest imports are substantially less: from 57.3 to 63.5 inches. Under most state laws trucks and buses are not permitted to exceed ■ inches unless they are issued special permits.

Road and lane widths vary widely, depending on when they were built or improved, and on the standards of the local, state, or federal agencies concerned. However, the U.S. Bureau of Public Roads estimates for POPULAR SCIENCE that:

1. The earliest paved roads had 7- or 7½-

foot lanes—i.e., were less than 15 feet wide. Such widths are of course unsatisfactory for two-way traffic today.

2. Widths increased in one-foot increments. Many eight-foot-lane roads were built in the 1920s. By the early 1930s, when extensive road building was done, nine-foot lanes were most common. Many such highways are still in use, though experience shows them dangerous at today's vehicle widths and speeds.

3. Standard on today's highways are 12-foot lanes. Thus a 24- or 25-foot road may be either a three-laner built in 1925 or a two-laner built recently.

4. The width of a road's shoulders has a close correlation to its accident-frequency record: the narrower the shoulders, the more hazardous the road.



Ferris-wheel digger

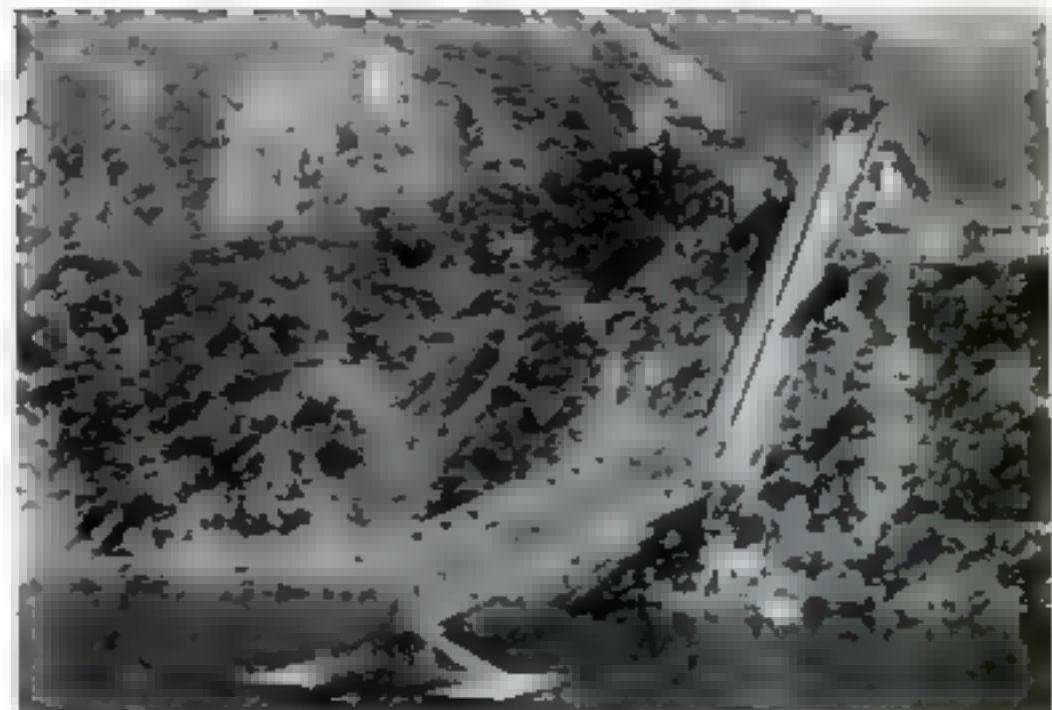
It's all work and no play for this 50-ton German ditch-digger, although it looks like a Ferris wheel set up at a county fair. The revolving scoops of the machine can move more earth in a few minutes than one man can in an entire eight-hour day.



Mobile laundry

The old bus above, retired as obsolete, was put back to work by six farm families near Paderborn, West Germany, in a new kind of cooperative.

They tore out the seats, installed a washing machine in it instead. It spends one day a week at each of the six farms, does the family wash. A tractor hauls the engineless bus trailer from farm to farm.



VARIABLE-ANGLE LAUNCHER tests missiles. Underwater electronic gear suspended from a barge gathers data.



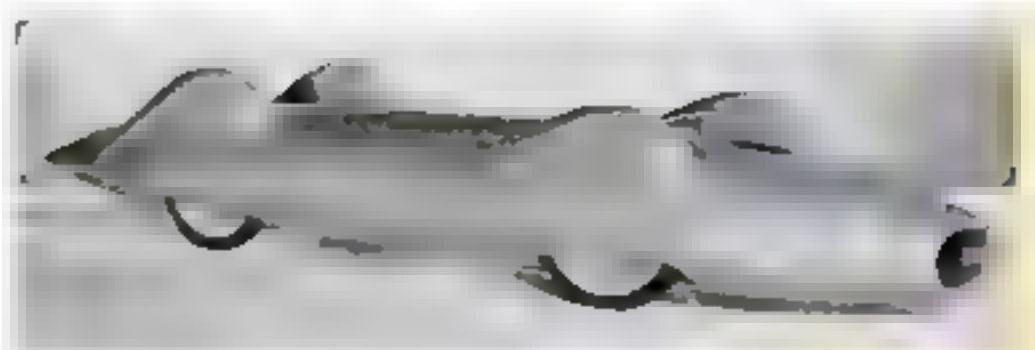
COMPRESSED AIR from tank between center beams catapults projectiles through the tube at high speeds.



WHOOSH! Here goes a missile into 160 feet of water. Located by diving crew, it is winched back to shore.

Ski jump for missiles

The 300-foot "bridge" pictured here that seems to go off into nowhere is used by the Navy at its Morris Dam testing site in California to simulate the firing of missiles at various speeds and angles of attack. Speed is controlled by compressed air in a launching tube carried by the bridge structure; angle up to 40 degrees, by raising or lowering the upper end on rails laid on the concrete ramp above it. The outboard end rests on floats.

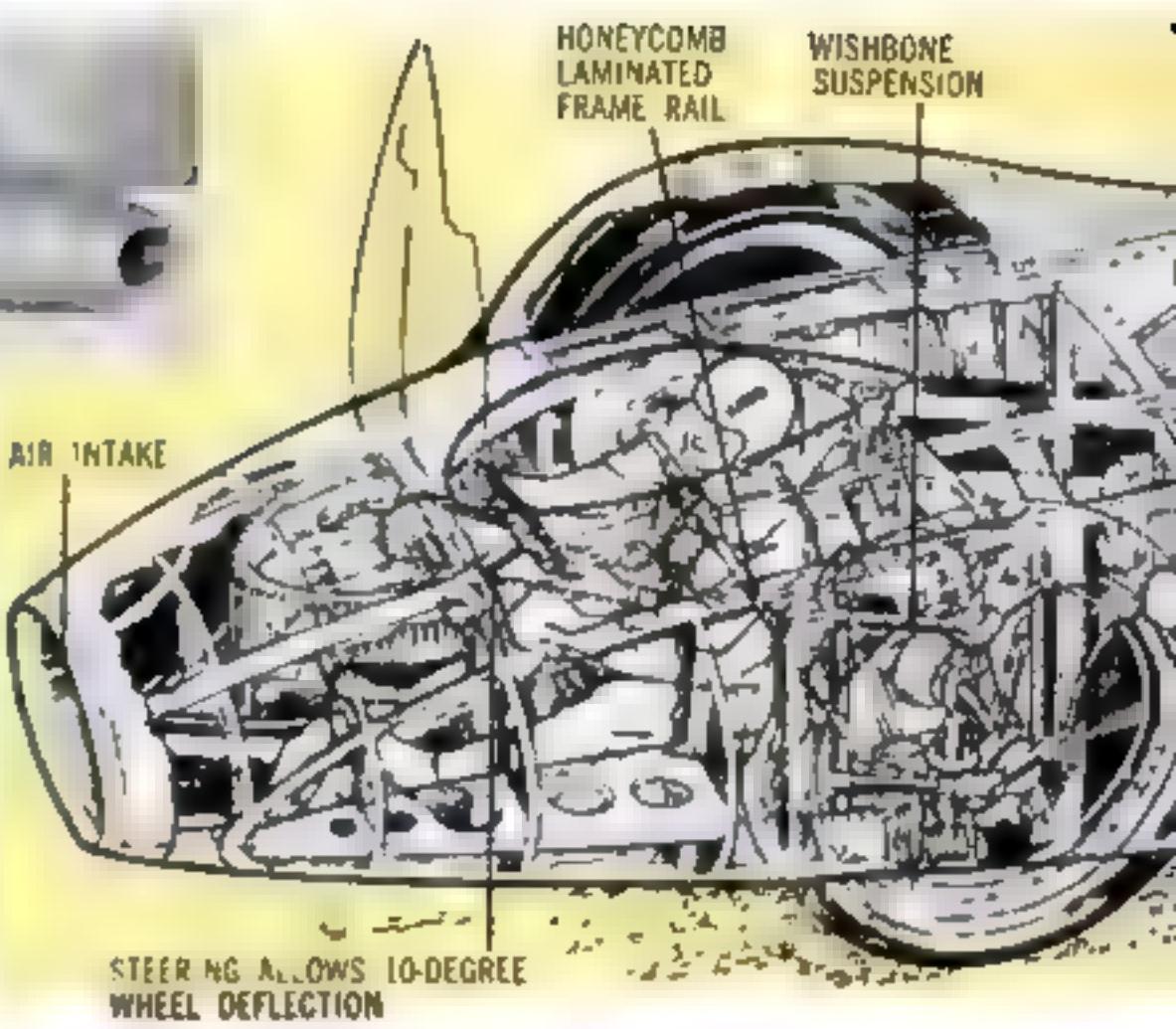


STREAMLINED DESIGN of the 30-foot racing car shows in this model. Wheel wells tower over the cockpit.

Turbocar to try for speed record

CUTAWAY DRAWING by artist for Britain's *The Motor* reveals unorthodox frame and setup of four-wheel drive. Jet propulsion is ruled out by international racing regulations."

Sometime next month this \$3,000,000 racing car will attempt to break a 13-year-old land-speed record at Bonneville Salt Flats in Utah. It's Donald Campbell's newest Bluebird, powered by an aircraft turbine, with which he will try



for 400-plus m.p.h. A Bristol Siddeley Proteus turbine driving all four wheels and developing over 4,000 hp. gives the 8,000-pound car an unprecedented power-to weight ratio of less than two pounds per horsepower. Fuel is injected into the



Now: igloos in Florida

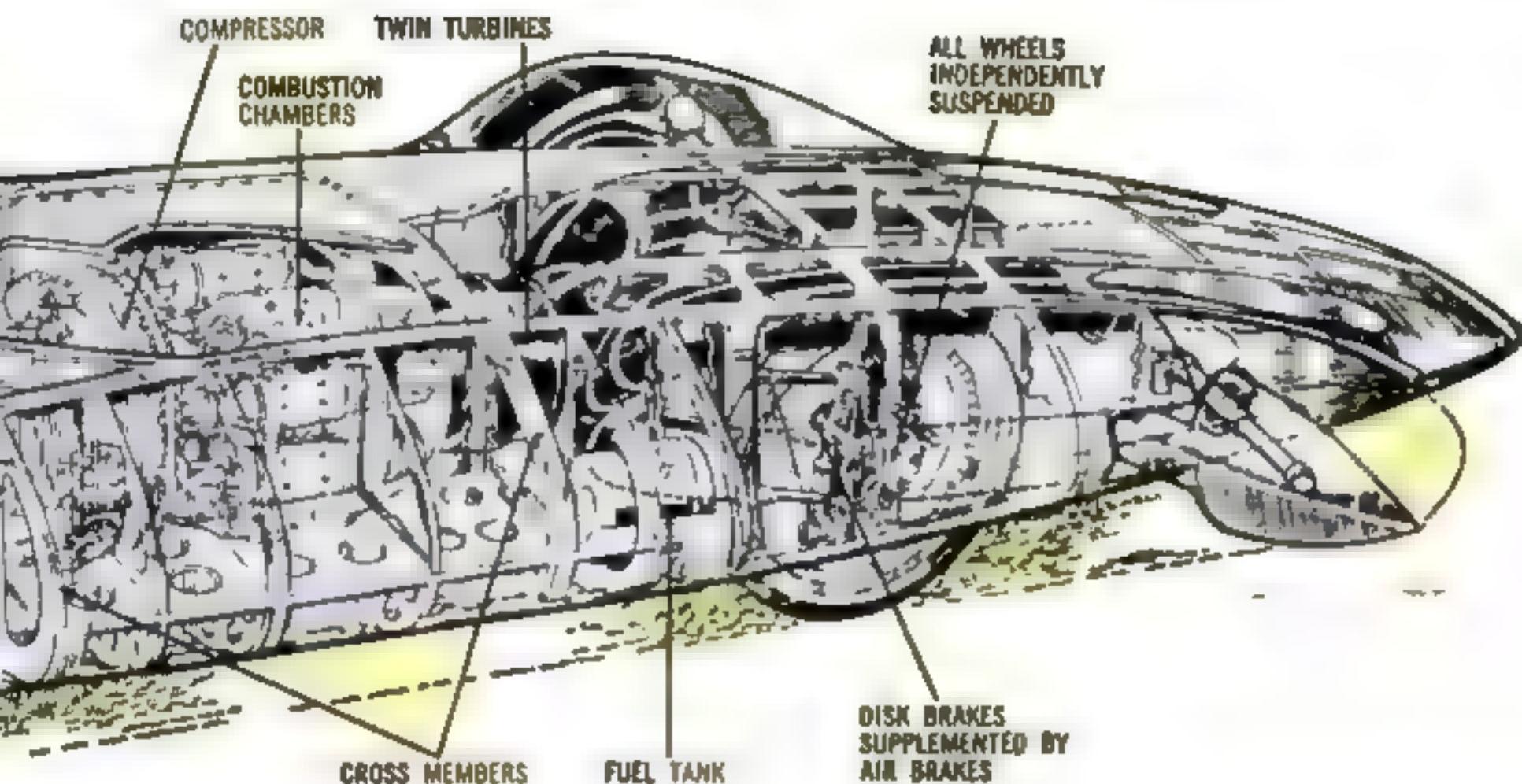
The two concrete domes above will house men and equipment handling the new Minuteman ballistic missile when tests begin at Cape Canaveral, Fla., late this year. The shock-resistant blockhouses will be further reinforced with a layer of sandbags during blast-offs.



Having a ball

An American League umpire is taking new balls from a pop-up basket in the White Sox's Comiskey Park.

The Chicago innovation, installed under a trap door about 10 feet behind home plate, holds 20 baseballs. It's raised by an attendant on a signal from the ump, retracts when the ump has been resupplied.

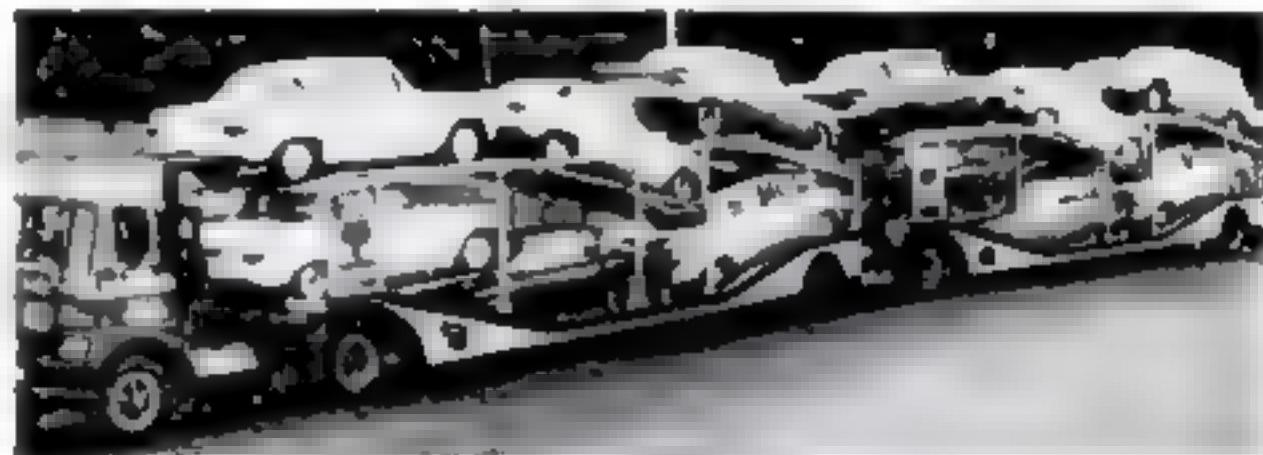


airstream in the ignition chambers, and the resulting combustion drives twin turbines. One drives a compressor; the other turns the drive shaft geared to all four wheels. Air for the compressor comes from the nose intake. The car took five

years to build, with 68 British manufacturers participating. The present record—394.196 m.p.h.—was set in 1947 by the late John Cobb, also of England. Campbell, son of Sir Malcolm Campbell, holds the speedboat mark of 260.35 m.p.h.

Loaded cars

A dozen cars ride the experimental 90-foot tandem transport at right. A White tractor that can haul 50 tons provides the power. The unit is being road-tested on the Ohio Turnpike.



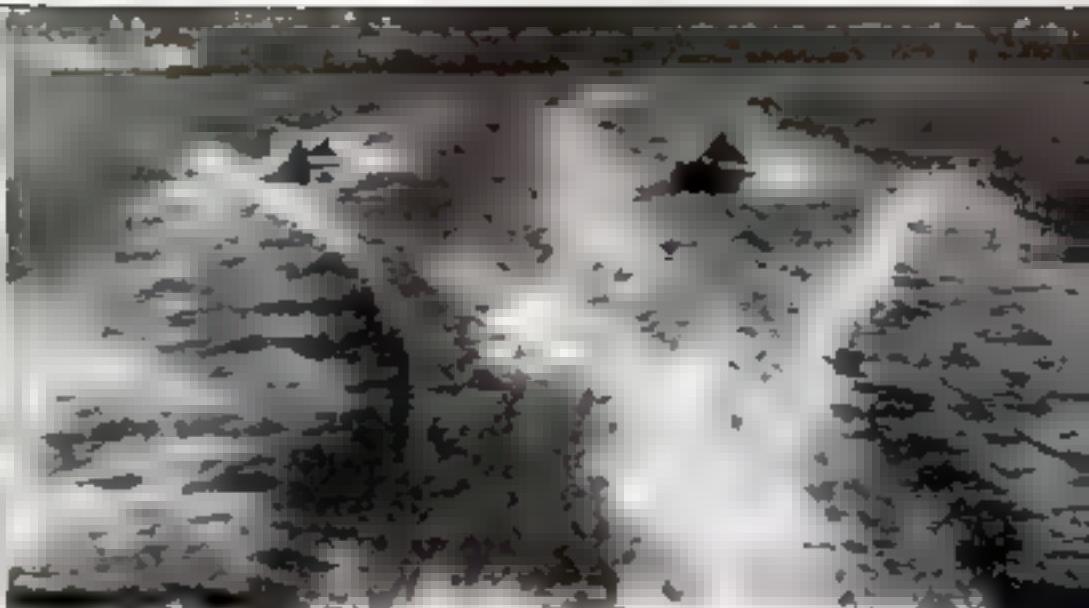
Underwater ski

Picture upside down? No—this Florida sea nymph just got bored with water-skiing in the ordinary way and decided to try this. She's still on the surface at Weeki Wachee Springs (or her skis are), but she's upside down and completely submerged. Except for holding her breath, it's not difficult, she says.





Sled gathers speed fast.



Now both pound along.

Navy Jetboat Snatches Frogmen on the Run



Steel beak welded to the jet-powered recovery boat catches the floating line between sleds, slings it to the winch.

Operation Big Jerk scoops 'em up like flying fish as rescue boat hurtles past at 45 knots

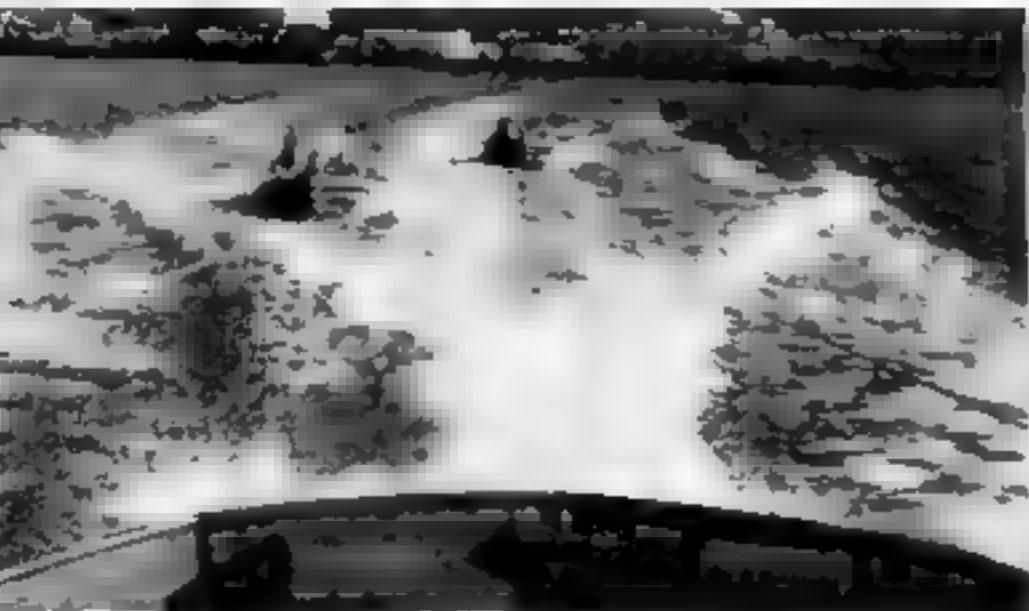
By Frank Harvey

BOB FULTON, a lean egghead who'd dreamed up this new maneuver for recovering Navy frogmen after a mission, was understandably nervous. He'd been up all night helping Lieutenant Commander Don Gaither's frogmen put the finishing touches on "Snatch-and-Run"—a method of grabbing an entire squad of Navy frogmen out of the water at one fell swoop, as fast as any Navy boat can move . . .

"I can't say what will happen," Fulton told me. "We've never done it before. This isn't a demonstration, actually—it's a virgin test."

In two thrilling minutes, the jetboat completes its snatch





Winch takes up on lines.

The stench of burnt jet fuel drifted warmly across the deck of the Underwater Demolition Team's gas-turbined assault boat. The two gray pickup boats—"sleds," Fulton called them—were nested on the rear deck. They were connected by 300 feet of braided bright-yellow plastic line—which fed into the mouth of a fur-lined bag. Beside the boats knelt Lieut. Jack Alexander, whose job it would be to "cast" the boats for the waiting frogmen at the proper instant.

"You better sit down to take your pictures," Fulton said. "It'll be rough—and wet."

I sat down as the jet engine's whine sharpened, and the assault boat nosed free of the dock and headed out into the harbor of St. Thomas, Virgin Islands. Ahead, across a mile of glittering blue water, bobbed two groups of black specks. They were Navy frogmen, treading water out there, about 300 feet apart. If things worked as Fulton planned, we'd snatch them all aboard in a matter of seconds, moving wide open.

The jetboat gathered speed. The "pickup probe"—an underwater beak



Get ready for boarding!



Scramble at 45 knots.



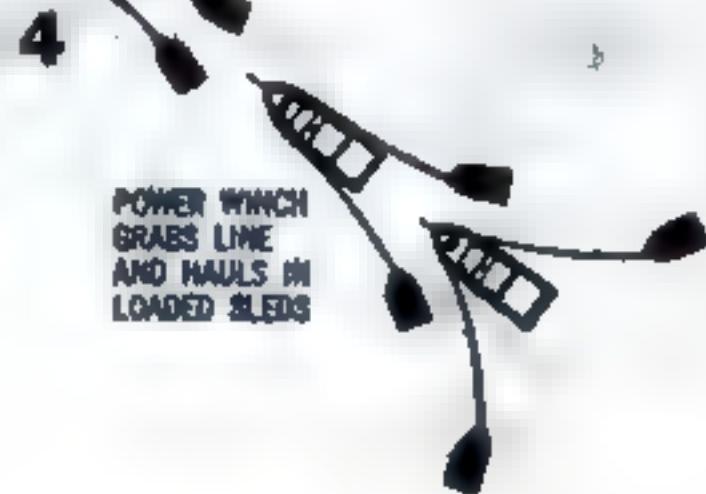
Nothing to it, was there?

3



ASSAULT BOAT COMPLETES TURN AND HITS LINE CONNECTING SLEDS DEAD CENTER

4



POWER WINCH GRABS LINE AND HAULS IN LOADED SLEDS

CONTINUED



When the line comes flying over bow, two metal horns stop it at the winch, which snares it automatically. Horns act as outboard guides for the lines astern.

welded to the prow of the boat—sliced cleanly through the water. Perched on its Caribbean hillock, the Granboko Hotel (a World War II BOQ with a posh paint job) receded rapidly behind. Now we hit the harbor chop. The beak began to hiss, then vibrate, throwing sheets of spray past us like driving rain. I huddled on the deck, facing aft, feet braced against the steel coaming, camera focused on the long furrow of white water behind us.

Out go the sleds. Suddenly I saw Jack Alexander bend and fling one of the gray sleds overboard. They were like unfinished small boats—lacking transoms. There was a flash of upturned faces close by—the first group of water-treading frogmen. The gray sled stayed beside them as they dwindled through the spray, and the yellow line, paying out furiously from its fur-lined bag, became a thread in the distance.

Then Jack flung out the second sled—beside the second group of waiting frogmen—and the big assault boat stood on its stern in a vicious reverse turn. In the distance, on our beam, I could see

blurred figures swimming into the gray hulls, lying flat, getting their grips on the holes in the fiber-glass hulls—preparing for the Big Jerk.

The harbor was wheeling around against the sky . . . was gone . . . and we'd completed our circle and were screaming toward a point midway between the now-loaded sleds.

"This is it!" Fulton yelled.

The catch. I disgorged the Nikon from my wadded shirt (where I'd put it to protect it from spray) and focused it for distance. Our racing boat hit the nylon line in the exact center. The beak snaked the line up over the prow into the waiting jaws of the power winch. The two loaded sleds, far out on either side, suddenly jerked like fresh-hooked trout and began angling in rapidly toward the trough of white water which was our wake. The two boats closed until they were side by side in the white water. The winch reeled them toward us smoothly and rapidly. They dead-ended on the trailing "boarding mat"—11 feet of canvas reinforced with wood battens—riding the wake.

The frogmen were coming aboard now, and snatching the gray sleds over the stern. The assault boat was hurtling around the corner of a Caribbean mountain, never once having slackened its pace. Two minutes from the time we started our run we had everybody safely aboard.

Copacetic. I wiped the spray off my camera and closed it. Beside me I saw Bob Fulton, soaked to the skin, with a wraparound grin that might have been visible on the shore in an ivory flash if the sun had hit it. There was too much noise and flying water for conversation, but Fulton used a hand signal. He closed the thumb and forefinger of his right hand and held it up, fingers stiff, in the old Navy copacetic gesture.

Well he might. Snatch-and-Run had been an obvious unqualified success. No more "bungee cords that practically rip a man's arm off." No more "one man at a time—sweating out the shore guns." With Robert Fulton's new gimmick, the Navy had itself something painless, cheap, and completely practical. "It's just a question of time, in my opinion," Commander Don Gaither told me later, "before Fulton's method will be standard for this sort of thing throughout the Navy."



World's fastest camera

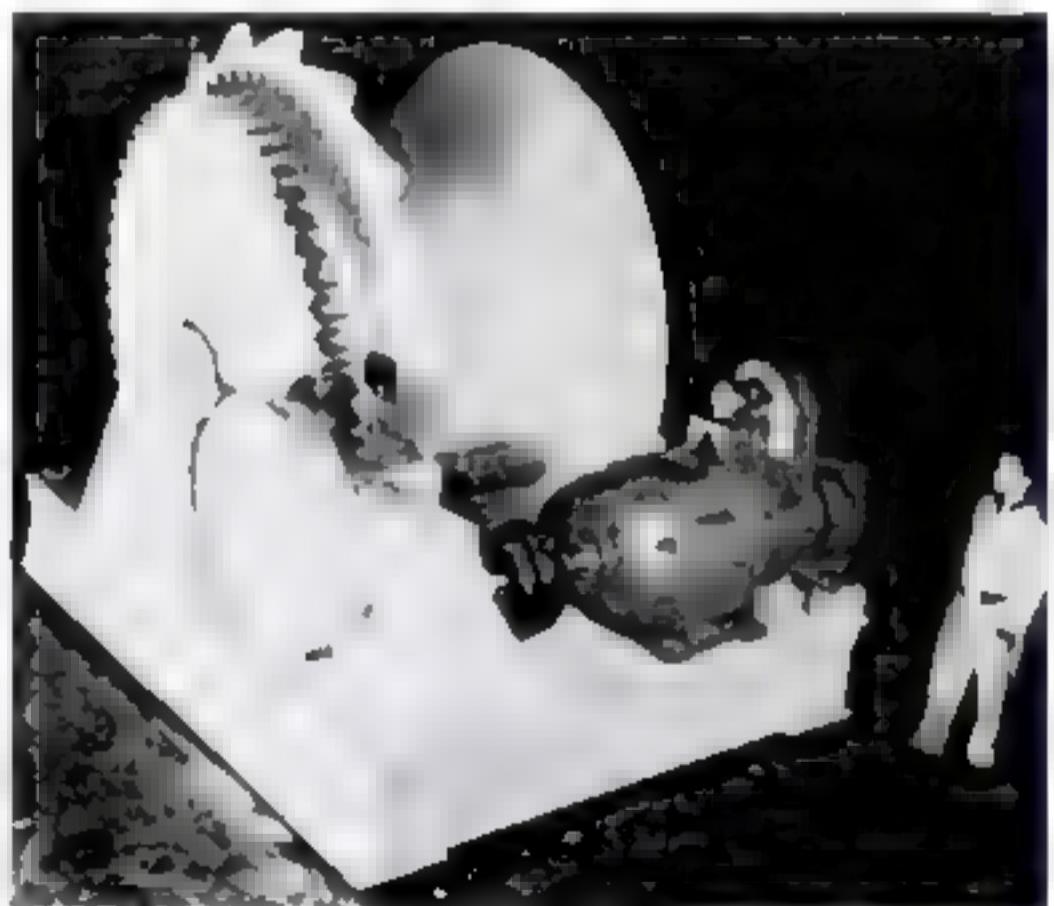
Scientists at the Army's Picatinny Arsenal at Dover, N.J., are using the world's fastest camera shutter to study what happens during an explosion. Fitted with a Kerr cell, their new camera takes still pictures in a five-billionth of a second. For comparison, half a second is a five-billionth of a century. The Kerr-cell

shutter works electronically: An opaque liquid is made briefly transparent by a polarizing pulse of electricity. So short is the exposure that the light of the explosion itself is not sufficient. Additional light must be provided by simultaneously setting off an argon-gas bomb. In pictures so far, the scientists have been able to take photographs of shock waves traveling at 18,000 m.p.h.



Radio runs mower

This lawn mower will cut your grass while you rest. The radio-controlled device takes its orders from the control box held in the girl's lap. It was demonstrated in a "garden of the future" on display recently in Paris' famous Luxembourg Gardens.



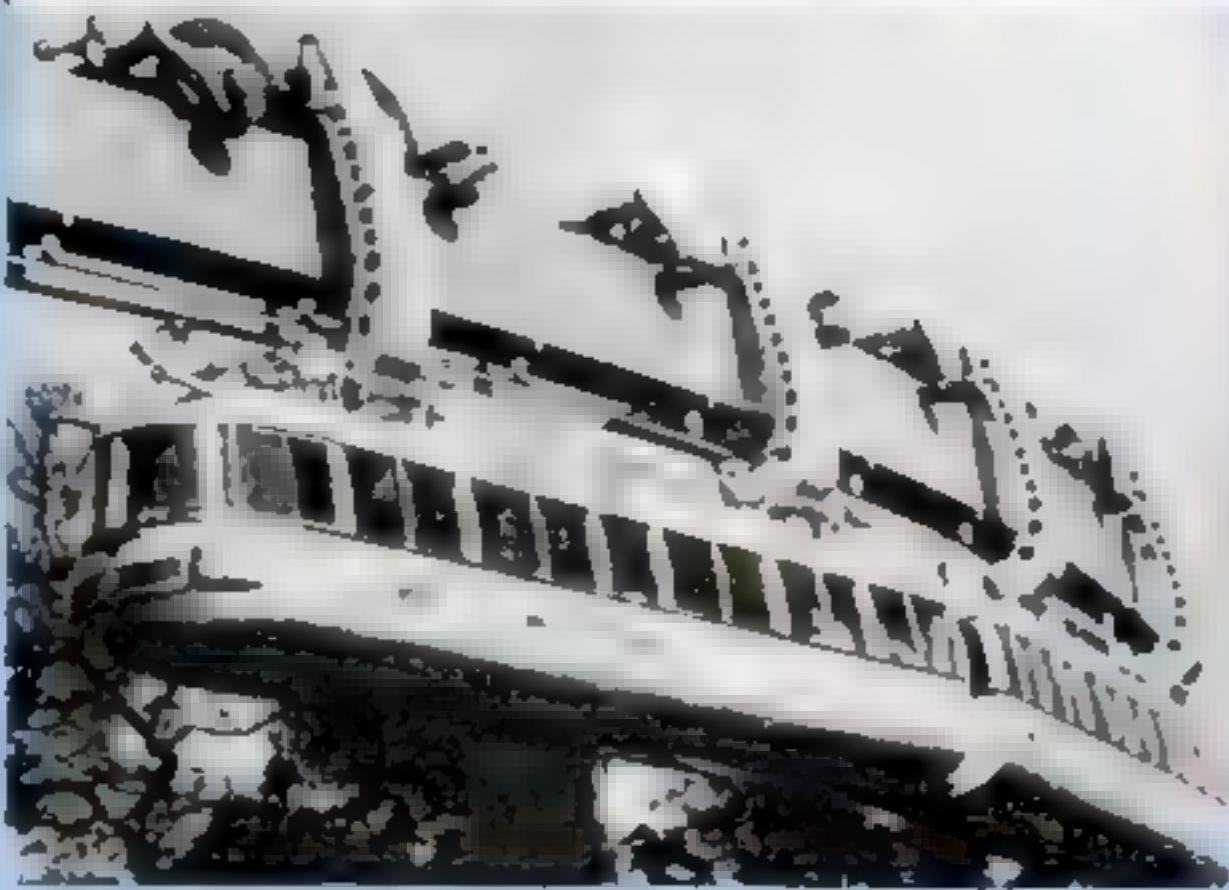
There's big pulling power here

The mammoth winch that dwarfs a six-footer above is 10 feet wide, 17 feet long, and 12 feet high. It's powered by a 200-hp. electric motor through a gear train meshing with a nine-foot-diameter final-drive gear bolted to the cable drum. It develops a pull of 300,000 pounds—greater than that of four 1,200-hp. locomotives. L. G. LeTourneau, Longview, Tex., built it for the Navy.

Do Monorail

AT 60 M.P.H., Alweg car takes steeply banked curve of 2 5-scale line built in Germany in '52. Full-scale one was completed there in '57.

PROPOSED MONORAIL system for Japan's capital is tested by 1,200-foot electric line of '57, shown in photo from Tokyo Metropolitan Government. Cars' pneumatic-tired wheels run in trough atop girder, guide wheels, on sides. Suspended-type demonstration lines were also built at Dallas and Houston, Tex., in '56.



NEWEST MONORAIL, called the Metro Aérienne or "overhead subway," makes its 1960 debut on a mile-long demonstration track at Chateauneuf-sur-Loire in France. Single or in trains, its Renault-designed electric cars glide silently at average of 62 m.p.h. Arranged in pairs, pneumatic-tired wheels of car run inside big hollow girder and along its bottom straddling slot for car's hanger arms. System is first of suspended ones to apply this promising split-rail design.



Trains Make Sense?



LATEST U.S. MONORAIL LINE, completed last year at Disneyland, carries passengers in $\frac{3}{4}$ -scale Alweg cars shown in Disneyland-Alweg photo. Three-car trains ride concrete beamway,

elevated on pylons, forming track 3,650 feet long. Alweg design is also to be used for mile-long Seattle monorail line, from center of city to site of its coming Century 21 Exposition.

An unusual study separates fact from fancy about the one-rail lines we may be riding tomorrow

By Alden P. Armagnac

TRAINS of tomorrow will ride a single rail, say the sponsors of a futuristic-looking new crop of monorail designs. Soon they expect to be able to point to a monorail transit line in a major U. S. city—a projected mile-long system to whisk passengers between downtown Seattle and the site of its Century 21 Exposition, in 1962.

Seattle's monorail will be the fore-runner, they predict, of glamorous new railways in the air. On slender and graceful overhead tracks, lightweight aluminum cars will glide silently at 60 m.p.h. or more. Built at a fraction of the cost of conventional lines, the monorails will solve the problem of speeding 10,000,000 U.S. commuters in comfort between homes and work, starry-eyed promoters declare. How well do their glowing claims bear close examination?

Some hard facts: Thirteen operational

monorail lines have been built so far—two, quite recently, at Disneyland in California, and Tokyo, Japan. Of the 11 that have had ample time to prove themselves, most were short-lived failures. Just two were successful, reports Hermann S. D. Botzow Jr., New York transportation engineer.

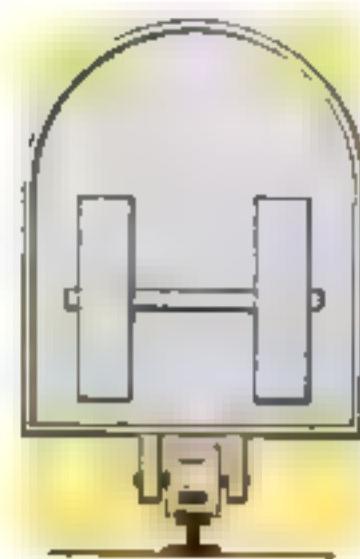
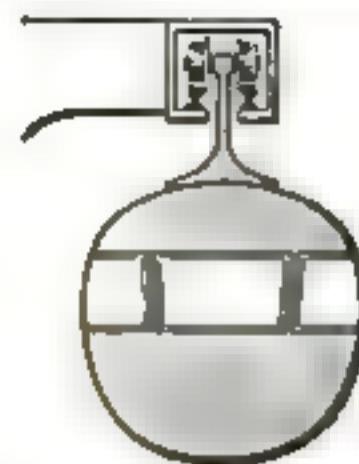
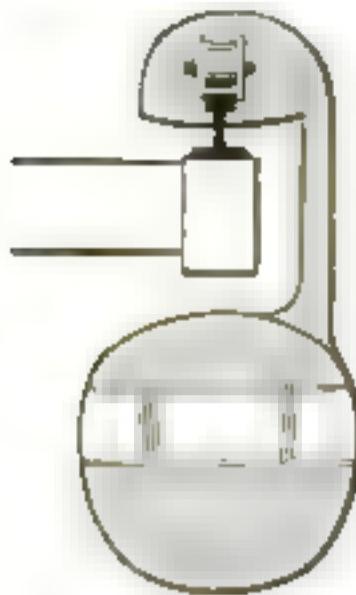
In a new 104-page book, *Monorails* (Simmons-Boardman Publishing Corp., New York, \$3.95), he presents a detailed study he has made of one-rail lines' past performance and future possibilities. The result is a revealing picture of what monorails can and can't do.

Does "monorail" suggest to you half a regular railroad track—one standard rail on sawed-off ties? Just one kind actually had a track as simple as that. The Brennan Gyro-Car, built in England in 1909, balanced itself with spinning gyros on one ordinary rail laid along the ground. It found no takers. How to keep it from toppling over, if the gyros stopped, still awaits an answer.

Practical kinds of monorails are illustrated by two early lines:

Germany's 8.3-mile "swinging railroad" in the Wuppertal Valley, now in

Monorail trains may roll beneath their track—or above it



SUSPENDED TYPE, with cars below track, may be of "classical" one-rail kind (left), or newer "split-sail" variety using two rails (right). Since track of split-rail version is enclosed in single girder it is classed as a monorail.

its 59th year of successful operation, is a "suspended" monorail. Its trolley-like cars, carrying more than 50,000 passengers daily, hang from a one-rail track. Double-flanged steel wheels, above their roofs, suspend and propel the two-car electric trains. Designed by Eugen Langen of Cologne, the line skims a river through a teeming industrial area.

Longest monorail was the picturesque 9½-mile Listowel & Ballybunnion Railway in County Kerry, Ireland. Operated successfully from 1888 to 1924, when it succumbed to mounting repair cost and highway competition, it applied a "supported" monorail design developed by a Frenchman, Charles Lartigue.

SUPPORTED TYPE, with cars atop track, includes gyro-balanced car (left), undeveloped because of hazard if gyros stopped; and modern "saddlebag" design with guide wheels (right) as applied in Alweg monorail system.

Steam locomotives with twin boilers, and Siamese-twin cars, all rode astride a rail on three-foot-high A frames. Auxiliary wheels, engaging guide rails on the sides of each A, steadied engine and cars. For a train to run smoothly, the weight of passengers or freight on opposite sides still had to be carefully balanced. A resourceful L & B trainman once solved the problem of transporting a cow by putting two calves on the other side; on the return trip, the calves rode opposite each other.

Since 1950 have come the advanced monorails, of both types, pictured on the two preceding pages. Latest in suspended monorails, so new that it existed only

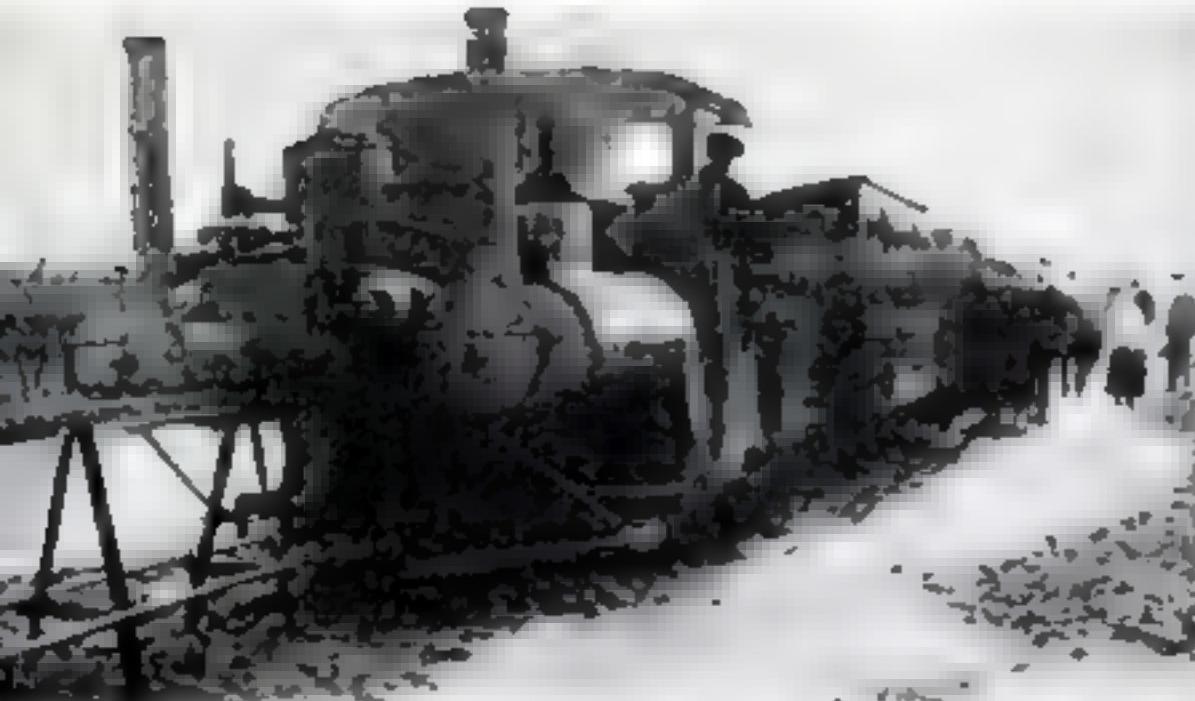
Monorail systems bring innovations—and novel problems in engineering, too

Stations, bridges, and other things besides trains will get a new look in monorail lines—as shown at right in Alweg system photos (from Alweg International, Inc.) and others. And with these innovations come odd problems, not all solved as yet. Preventing falls from station platforms without hindering access to trains offers puzzle. So does design of switches for suspended-type monorails.



STATION on Alweg line in Germany has gates to trains and safety net, for lack of intervening structure to prevent a fall from platform to street.

BRIDGE for monorail can take novel form of this soaring arch with a single central girder, on the Wuppertal "Schwebebahn" (swinging railroad) in Germany.



SIAMESE-TWIN ENGINE and cars straddled track of early Irish monorail line, the 9½-mile Listowel & Ballybunnion R.R., as shown in 1924 photo from *The Railway Gazette*. It was longest monorail to date, and a successful one.

"SWINGING RAILROAD" in Wuppertal Valley of Germany, another early monorail, is still going strong. Two-car electric train, seen in photo by Manfred Jakob, hangs from single rail above it as 8.3-mile-long line skims river.

on paper when Botzow concluded his recent study, is a promising French "split-rail" version. This car's pneumatic-tired wheels run inside its track, a huge hollow girder, straddling a slot for the car's hanger arms. Though the divided bottom of the girder amounts to two rails—it would actually have two rails, for a steel-wheeled car—this design is still classed as a monorail, because of its single enclosing girder.

Modern version of a supported monorail is the Alweg design, developed in



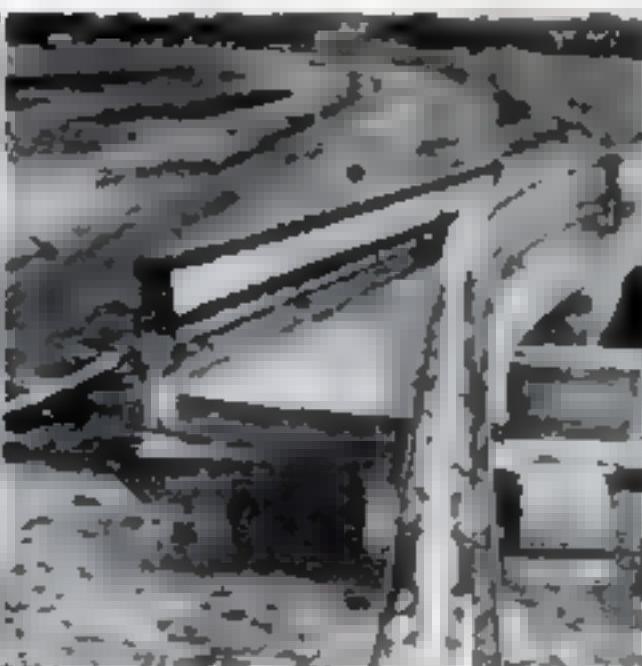
Germany with the backing of Axel L. Wenner-Gren, Swedish industrialist. A steel-faced concrete beam, elevated on pylons, serves as its track. Electric-powered cars ride the beam on pneumatic-tired wheels, while auxiliary wheels engage its sides. Thus steadied, trains have sped smoothly at up to 88 m.p.h. on a 1½-mile demonstration track near Cologne in Germany.

Now Disneyland has the first Alweg-type passenger line. Likewise, the Seattle

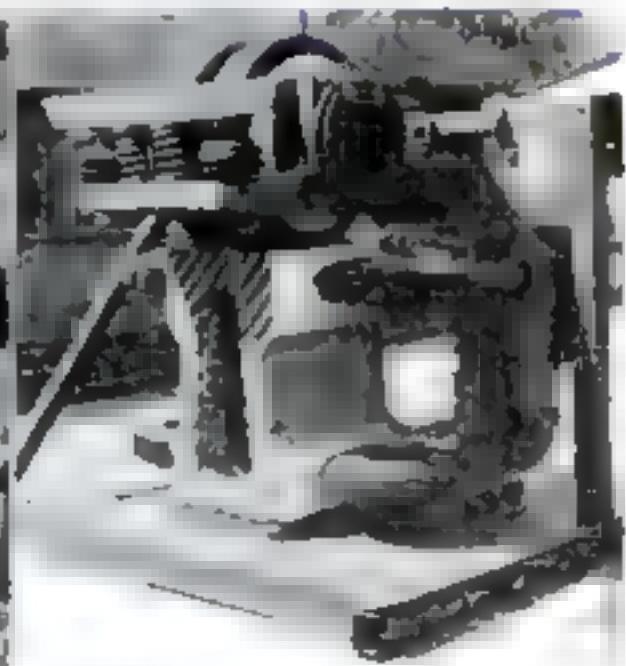
[Continued on page 192]



EMERGENCY EXIT for passengers trapped in a stalled train is provided by escape chute lowered to the ground from bottom of Tokyo line's monorail car.



SWITCH for monorail takes this unconventional design on Alweg demonstration line in Germany. Suitable kind for suspended-type monorail line is still to come.



BOGIE of Alweg car is shown on section of its beamway. Pneumatic-tired wheels stop beam support car and propel it; the others serve to steady it.



Coin dropped in slot . . .

. . . turns on sun lamp toasts you on spit.

Slot-machine sunshine

In England you soon may be able to get a sun tan on a cloudy day for a shilling. An ultraviolet tube has been rigged up with a coin dispenser and a turntable

that revolves slowly to give you an even two-minute burn on all sides. James Morgan, Bedfordshire physiotherapist, invented the device, calls it Solarota. He plans to install machines in drug stores and hairdressers' shops.



Cooling an arctic boat ride

Far-north Alaska, like the other, more southern, 49 states, gets pretty hot in summer. When Jack Bremer equipped his houseboat *Insulaire* for the 2,500-mile cruise he is now undertaking down the Yukon River, he installed a trailer-home

air conditioner on the roof. The cruise began at Whitehorse in Canada's Yukon Territory and is expected to end at the Bering Sea near Nome. Last word from the professional adventurer is that the long hours of sun beating on the all-steel boat haven't raised the inside temperature to uncomfortable heights.



**With self-tuned music pouring
out of your earphones, and a
250,000-r.p.m. diamond drill that
wouldn't break an egg—**

Who's Afraid of the Dentist?

By Albert Q. Maisel

NO PEOPLE on earth spend more on their health than we do, yet last year nearly two-thirds of us failed to make even a single visit to a dentist. And almost one-third of us haven't entered a dentist's office in at least five years. If you are one of those who has been ducking dental treatment, your dentist may have some pleasant surprises in store for you. For revolutionary advances in the equipment he uses have now made it possible for him to do better work, faster than ever before, and do it while causing virtually no pain.

One pioneer of this new era was an Army dentist, Col. Carlos F. Schuessler, who 14 years ago took a long, hard look at the drill that made his patients fear him. Its handpiece was still similar in principle to that used on foot-treadle drills back in the 1870s. Its motor was almost exactly like the one on the earliest electrified drill of 1883. And even when he pushed its throttle all the way over, its burr turned at only 4,500 revolutions per minute—the same top speed dentists had been using for more than 60 years.

But Col. Schuessler did have one new thing: the tungsten-carbide and diamond-faced cutting burrs that had been developed for metal-drilling during World War II. He knew that these tiny drills

were designed to work best at high speeds. So he decided to experiment. He disconnected the resistors that held down the speed of his drill motor. And, when he let 'er rip, with his new burrs whirling at 9,000 r.p.m. and more, he found that he could prepare his patients' teeth for filling in far less than the usual time.

2,000 cavities. Other dentists were skeptical, however, until the Army's Medical Research and Development Board put Col. Schuessler's revved-up gadget through a grueling test. At Fort Belvoir, Va., 10 dentists, divided into two teams, prepared over 2,000 cavities for filling. The five who worked with standard-speed drills averaged five full minutes of grinding per cavity. The others, using the higher-speed devices, out-paced their rivals all the way. When the test was over, they had completed 266 more cavities than the first team for an average time-saving of 27 percent.

But it was another discovery that really astonished these experimenters. Soldiers on whom the 9,000 r.p.m. drills were used complained of pain far less than those subjected to low-speed drilling. And when the dentists checked their records, they found that the high-speed team had needed proportionately 16 percent fewer anesthetics than those who used the slower drills. Why?

Not until three years later was this



Compressed air drives this high-speed drill

PAINFUL VIBRATION of earlier, slow-turning drills is virtually eliminated by the Borden Airotor's 150,000-250,000-r.p.m. speeds. A water line from the console passes through the handpiece to the point of the drilling operation, effectively cooling the tooth

mystery cleared up, by a pair of researchers—Drs. J. P. Walsh and H. F. Symmons—working in New Zealand. They found much of the discomfort of slow-speed drilling was caused by vibrations transmitted through the teeth and the skull to the ears. But once the drill speed exceeded 6,000 r.p.m., the rate of these vibrations began to rise above the ear's ability to perceive them. From there on, speed could be increased by any amount without causing vibration-induced pain.

When this discovery was confirmed by American investigators, in 1952, thousands of dentists hastened to have their old drills remodeled or replaced.

Breakdowns. But, at these speeds, the old-style handpieces began to break down. Soon, however, equipment makers came up with new handpieces that overcame these difficulties. With these, drill speeds were stepped up to 30,000 revolutions per minute.

Researchers at the University of Michigan now discovered that high-speed drilling heated the vital pulp within the tooth, and the faster the drill the greater the temperature rise. With a high-speed drill, the pulp might be "cooked" and permanently damaged in just a few seconds.

To correct this trouble, the new drills were equipped with air and water sprays that turned on automatically whenever the dentist started his burr revolving. With these coolant sprays, drills could operate at any speed without inflicting damage to pulp or nerve. At first, dentists complained that the sprays fogged

their little mirrors and obscured their vision. But this difficulty was overcome when equipment makers developed powerful "evacuators" that work somewhat like a vacuum cleaner to remove the spray and debris from the tooth.

Another problem of high-speed operation was that the little gears inside the handpiece overheated and wore out at an astounding rate. The drive for higher speeds seemed to have reached its ultimate limit until, in 1955, Dr. Richard W. Page, a dentist in Chappaqua, N. Y., invented a way of eliminating gears entirely and carrying a belt drive right down through the handpiece to the pulley that turned the drill burr. With this ingenious device, drill speeds zoomed to 100,000 r.p.m. and higher.

The use of air sprays made it possible to eliminate motors, drive belts, and gears entirely, and to rotate the burr by means of a water turbine so tiny that it could be located right at the drilling end of a handpiece. Since 1956, nearly three-fourths of all American dentists have adopted high-speed or even *ultraspeed* drills which operate at from 200,000 to 300,000 revolutions per minute.

At such speeds, diamond-faced burrs can cut away enamel from 20 to 30 times as fast as the old-fashioned, slow-speed drills. And, instead of applying up to two pounds of pressure against the burr, as he formerly had to, the dentist can now literally whisk away decay with as little as half an ounce of pressure on your sore tooth.

Audio-analgesia now replaces anesthetics

MUSIC TO DRILL TO is the latest offering of dental-equipment manufacturers. A control box held by the patient pipes music into the earphones: classical, popular, or children's selections. A wide-spectrum masking sound blocks out intense pain.



To lighten their touch, many dentists practice cutting into extracted teeth, then move on to an "advanced" course, making controlled cuts on the shells of uncooked eggs. When they can make these cuts, time after time, without ever breaking the delicate membrane that lies below the shell, they are ready to use the new drills on their patients.

Ultraspeed drills have benefited the dentist in a host of ways. His costs have dropped because he needs fewer types of burs and each burr lasts much longer. He himself suffers far less physical and mental fatigue, and he is able to treat more patients. But the greatest beneficiary is the patient. The large burs used to cut away not only decayed enamel but much of the healthy part of a tooth as well. But the tiny burs used on ultraspeed drills can remove bits of enamel and dentine without destroying any healthy surrounding parts of the tooth. What's more, they shape cavities so accurately that fillings and inlays remain in place longer.

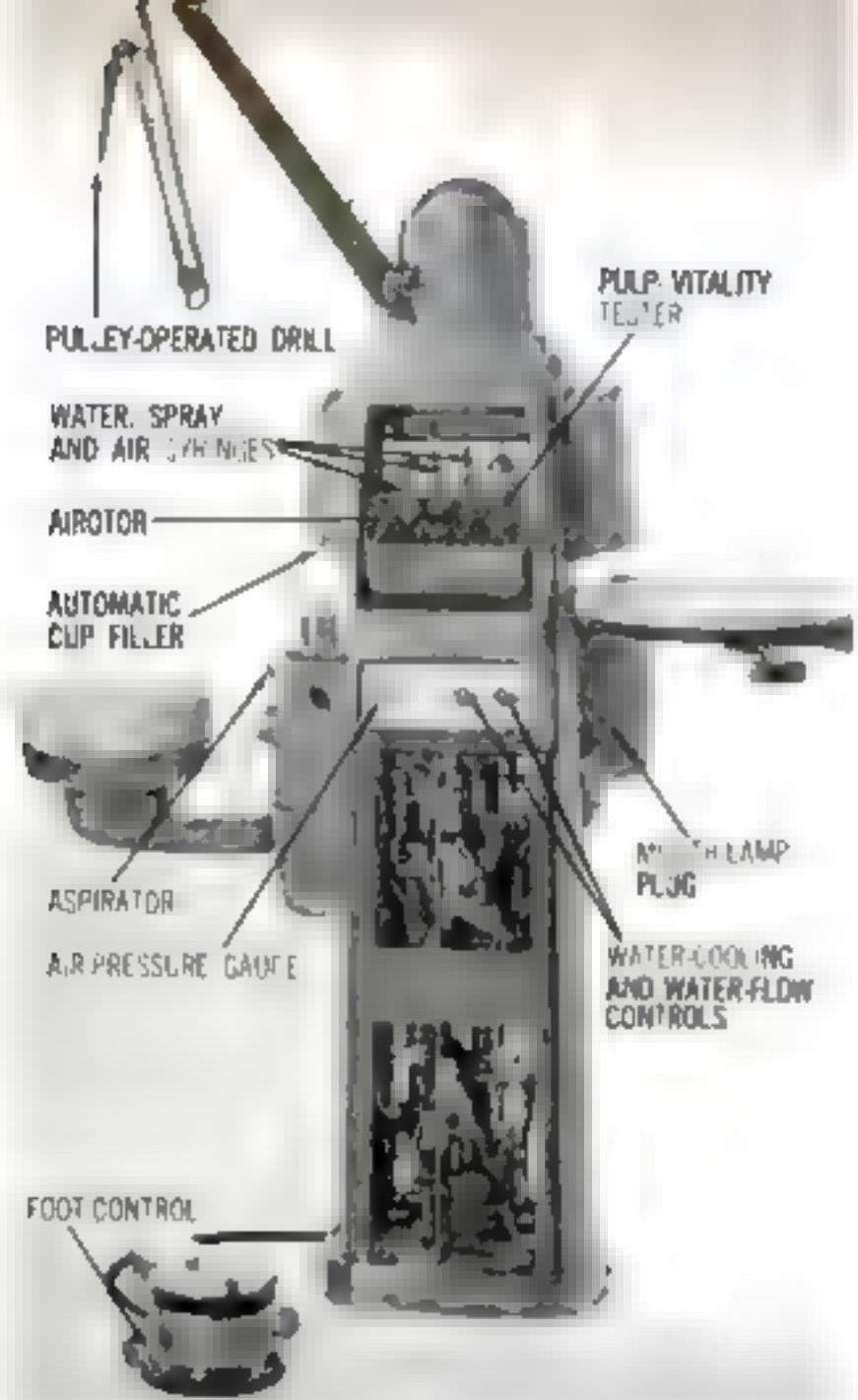
Even more important to most of us is the tremendous reduction in pain and discomfort we once thought inevitable in the dentist's chair. The amazing extent of this reduction has actually been measured at the School of Aviation Medicine at Brooks AF Base, Texas, by a team of researchers headed by Dr. Jack L. Hartley. Assigning an "Annoyance Index" of 10 to the old-style 4,500-r.p.m. drill, these Air Force dentists asked their patients to give comparative ratings in accordance

with the pain and discomfort they actually experienced under this and other, faster drills. Higher-speed instruments—80,000 to 120,000 r.p.m.—won ratings of "6" or "5." And air turbines, operating at 200,000 r.p.m., caused the least pain of all with annoyance ratings of only "3" or "4."

Still rosier future. Meanwhile, other dentists have been studying ways of wholly eliminating the discomfort of drilling and other dental procedures—the scraping of hand instruments, the prick of anesthetic injection needles, and extractions.

In Cambridge, Mass., for example, Dr. Wallace J. Gardner had experimented with slide projectors, movies, and TV sets to divert his patients' attention from his drill. But his battle against pain made only limited progress until, in March, 1958, an acoustics expert and psychologist, Dr. Joseph C. Licklider, entered Gardner's office as a patient. While discussing objectionable sounds in the dental office, the two agreed that the ordeal of drilling might be made more bearable if a masking noise, strong enough to drown out the whine of the drill, could be introduced into the patient's

A week later, Licklider arrived for his next dental appointment bearing a set of earphones and a black box full of tubes and transistors. Inside, he explained, was an electronic noise generator that would produce carefully selected or "shaped" sounds in the lower frequencies.



MAZE OF WIRING in Ritter console (panel removed) controls such apparatus as mouth lamp, cup filler, radiograph viewing screen, buzzer, water, air-circulating systems, Airotor drill.

Then he climbed into the chair, put on his headphones and permitted Dr. Gardner to drill away.

As soon as the grinding started, Licklider felt the expected pulsations of pain. Then he turned up the sound generator's control dial, expecting merely to drown out the drill noise. But, as the sound came through his headphones, roaring like Niagara Falls, he was astonished to feel his pain recede, then fade away entirely.

In the months that followed, Gardner and Licklider set out to perfect their first crude audio-analgesic—or painkilling-by-sound—apparatus. Testing it on volunteer patients as they went along, they introduced a recorder that could play any of a wide variety of music tapes and a control box that patients could hold in their hands, turning on music with one dial and using the other to bring in the

"waterfall" whenever they anticipated pain. For some patients, they discovered, music alone provided enough distraction to overcome most pain. Others required just a bit of added noise, now and then, while still others had to turn the waterfall effect all the way up every time the drill touched their teeth.

By the end of their first year of testing, Gardner had used his Audiac (audio-analgesia) in scaling and grinding operations on over 600 patients. Sixty-three percent reported completely effective suppression of pain. For another 25 percent, the noise-music combination so reduced the perception of pain that they refused anesthetics for later dental sessions.

The most severe test of audio-analgesia came when Dr. Gardner finally found a patient brave enough to undergo a needed extraction without anesthetic. As the forceps gripped his molar, the patient turned the noise volume all the way up and closed his eyes. When he opened them again, he couldn't believe the tooth was already out. "I felt you fooling around," he explained, "but where was the pain?" After that, Dr. Gardner performed 136 extractions with similar results.

Meanwhile, the acoustical research laboratories of Bolt, Baranek and Newman, Inc., a team of engineers, physiologists, and psychologists under Dr. Licklider, tackled the puzzle of why Audiac worked at all. They came to the conclusion that analgesia is primarily a physiological—rather than a psychological—occurrence. It works largely by a blocking action upon the nerves that transmit sensations of pain. Controlled sound simply swamps the pain "message" to the brain.

Since last December, when the *Journal of the American Dental Association* published the first detailed, clinical reports on audio-analgesia, hundreds of dentists have placed orders for the device. But, because production of its complex electronic components is an intricate process, several years may elapse before supply catches up with the demand. At that time, the combined use of ultraspeed drills and audio-analgesia may have made virtually painless dentistry a reality for all but the most pain-sensitive among us.

Next Month in PS: How You Can Protect Your Hearing



Air sled sets speed record

Skimming 12 inches off the ground on a cushion of compressed air, this wheelless Curtiss-Wright air car clocked 55.814 m.p.h. downwind—a world's speed

record for ground-effect vehicles. Best time against the wind was 46.936 m.p.h. The car travels over snow, mud, water, and dry land [PS, July '59].

Weather recorder

This odd device looks like a piece of abstract art, but it is practical enough to tell medics at Fort Hood, Tex., when the hot summer weather is too humid for GIs to work or drill effectively.

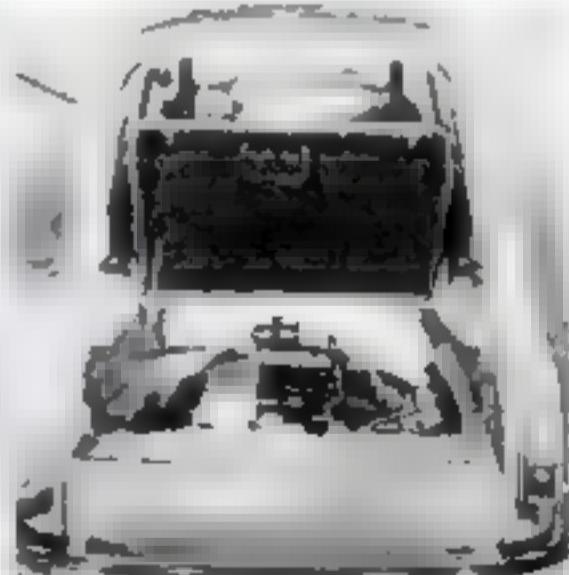
A wet-bulb thermometer at right works with a wick dipped in a flask of water covering the bulb; a dry thermometer under a helmet liner gives shade temperature; and the globe thermometer at left is suspended in a copper sphere painted black to indicate radiant heat. Readings, applied to a formula, give a wet-bulb, globe temperature index. At 88, the weather isn't fit for man or beast.



TINY WAGON HOLDS FOUR with room behind the folding rear seat for their luggage. The side-hinged tailgate opens wide.

Midget station wagon

Latest in the Fiat line is this baby "500" station wagon unveiled at Turin, Italy. It will carry four persons with



REAR ENGINE is easy to reach under the hinged cargo floor.

their luggage in spite of its tiny size. The rear seats fold down to provide more cargo room. A 17½-hp., two-cylinder engine is mounted under the rear floor. Car has a top speed of 60 m.p.h.



HENRY FORD, even as a multimillionaire proprietor of one of the world's largest manufacturing concerns, never lost his interest in unconventional designs. Often he was stubbornly unwilling to accept expert engineering advice that something wouldn't work—until after he'd tried it to see. This undated picture from the Ford Archives was probably shot around 1935.

Henry Ford's Weird Old Engines

By Ken Fermoyle

RADICAL engine designs—pancake sixes, narrow-angle V-4s, and fours amputated from V-8s, to name just a few—are much in the wind in Detroit these days. But it would be wrong to think that this fresh wind of experimentation is really new in the Motor City.

For better than 30 years, it's true, auto makers have been generally conservative about engine design. They've had long dalliance with the L-head combustion chamber, and with the straight six and straight eight. Yet in the back rooms of the engineering departments, a few designers dreamed up some real crazy mills decades ago. None of them, it's safe to say, were crazier than some extraordinary Ford engines that I saw recently—forlorn, dusty, almost forgotten—in an old building in Dearborn, Mich.

There were some weird X-8s, an early V-8 with an aluminum block and overhead camshafts, an in-line five-cylinder engine, a wide-angle V-10, and an opposed eight. These fascinating freaks were the product of the cut-and-try engineering approach that Henry Ford

favored. The old man—stubborn, self-taught, often brilliant—didn't like to believe that anything was impossible, particularly if theorists said it couldn't be done.

The X-8s are a case in point. About 1920 Ford called in one of his experimental people, E. J. Farkas, and said: "Gene, you'll laugh at this, but I want to build a cross-shaped engine with eight cylinders. Let's get to work on it."

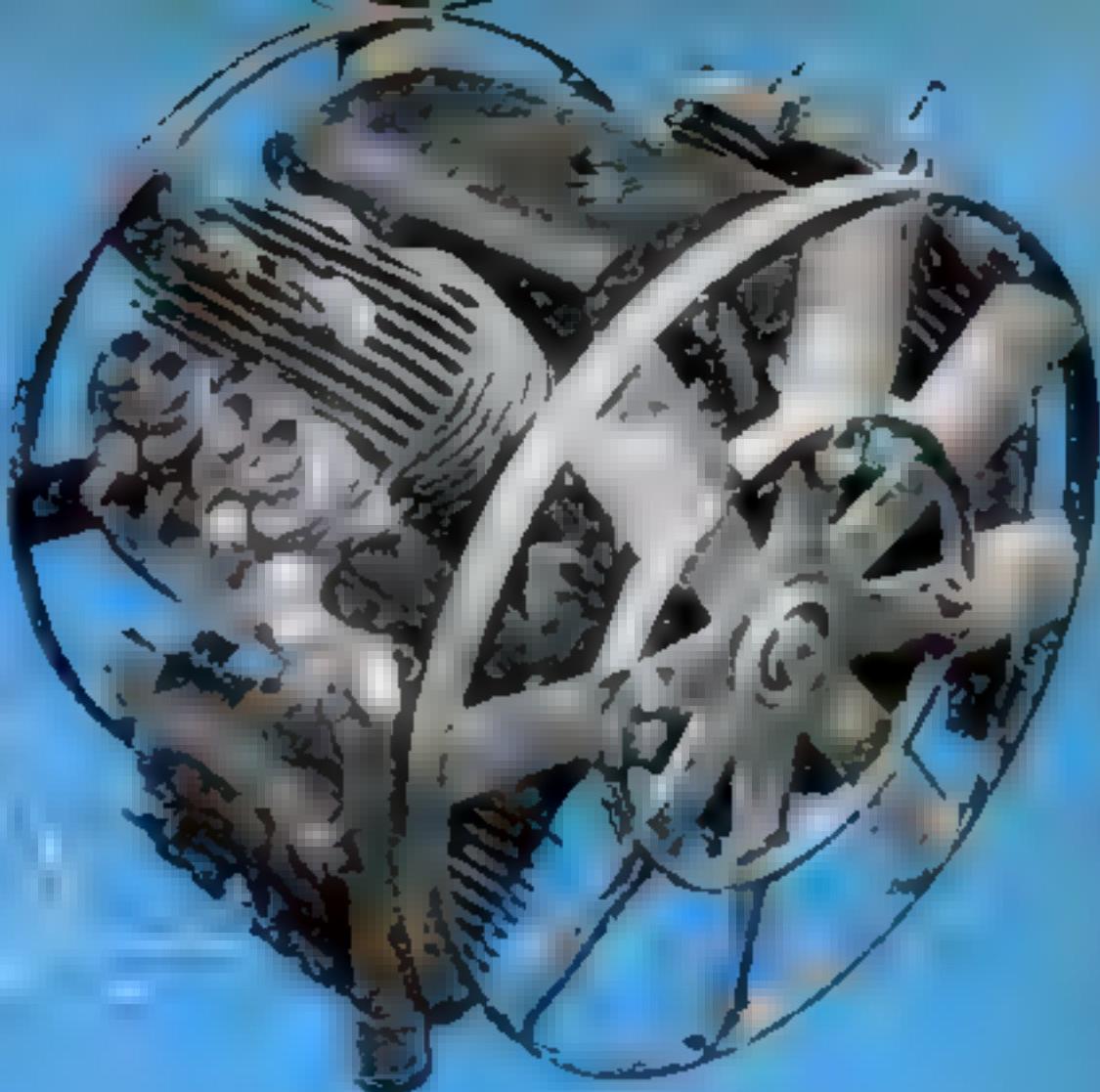
The project lasted seven years. At least 10—probably more—X-shaped engines were built. The first was air-cooled and had two camshafts, two timing gears, and battery ignition.

Harold Hicks, another member of the experimental group, reports that one of the early air-cooled X-8s displaced 107 cu. in., weighed 125 lb., and developed 35 hp. Put in a chassis, it hit 57 m.p.h.—an impressive dozen miles faster than the current Model T.

More advanced versions, with water cooling and pressure lubrication, came along. Meantime engineers sketched out X-engined cars. Some had engines up front driving rear wheels; some were front-engine front-drive jobs, and rear-

AIR-COOLED X-8 IN PROGRESS At right was one of the first experimental cross-shaped engines that Henry Ford had built. It has two gas tanks mounted between opposed cylinder banks; Ford favored green paint for his early prototypes.

31, progressed slowly. Meanwhile, Detroit Engineers developed a more experimental department originally. They also knew how air-cooled X-8 might be fitted to Duesenberg and two other Ford models mentioned.



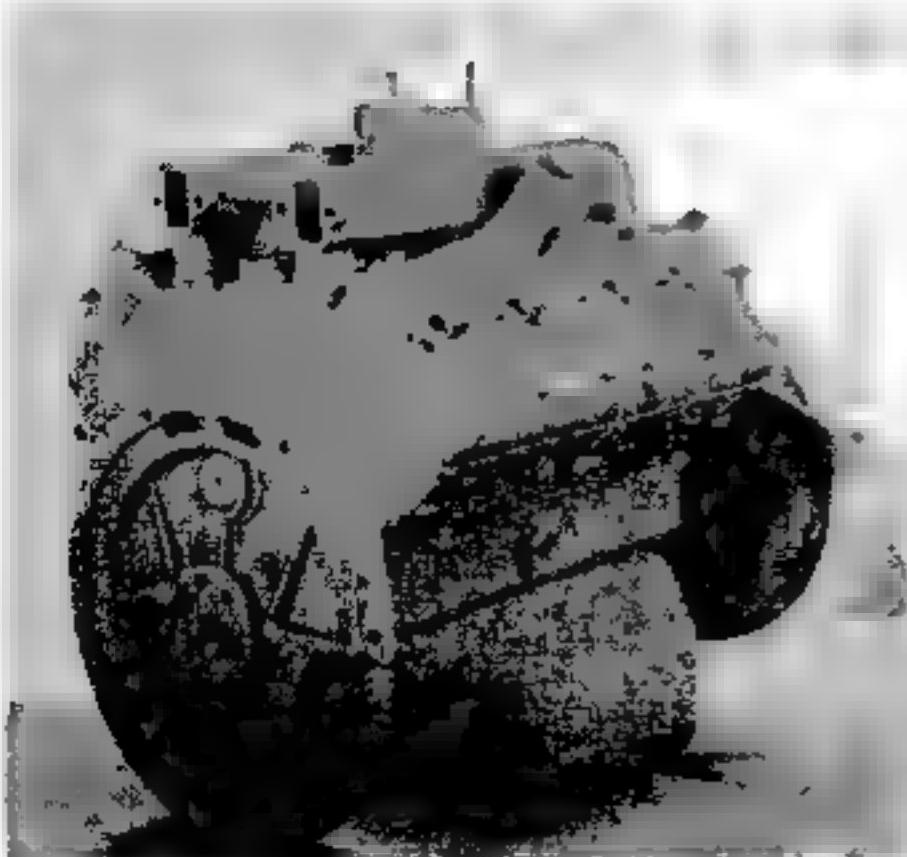
engine rear-drive cars; and some were four-wheel-drive.

Few car designs survived the stage of a full-size drawing, though experimental mechanics did install one of the later X-8s in an Olds chassis (it was too big to fit in a Model T). The engine had a 286-cu.-in. displacement and had a super-

charger built into its flywheel, a fresh, and as it turned out, inefficient idea. The car ran, but not very well.

One big X-8, designed for marine use, was installed in a boat for Edsel Ford. It made some trial runs before it developed fatal mechanical troubles.

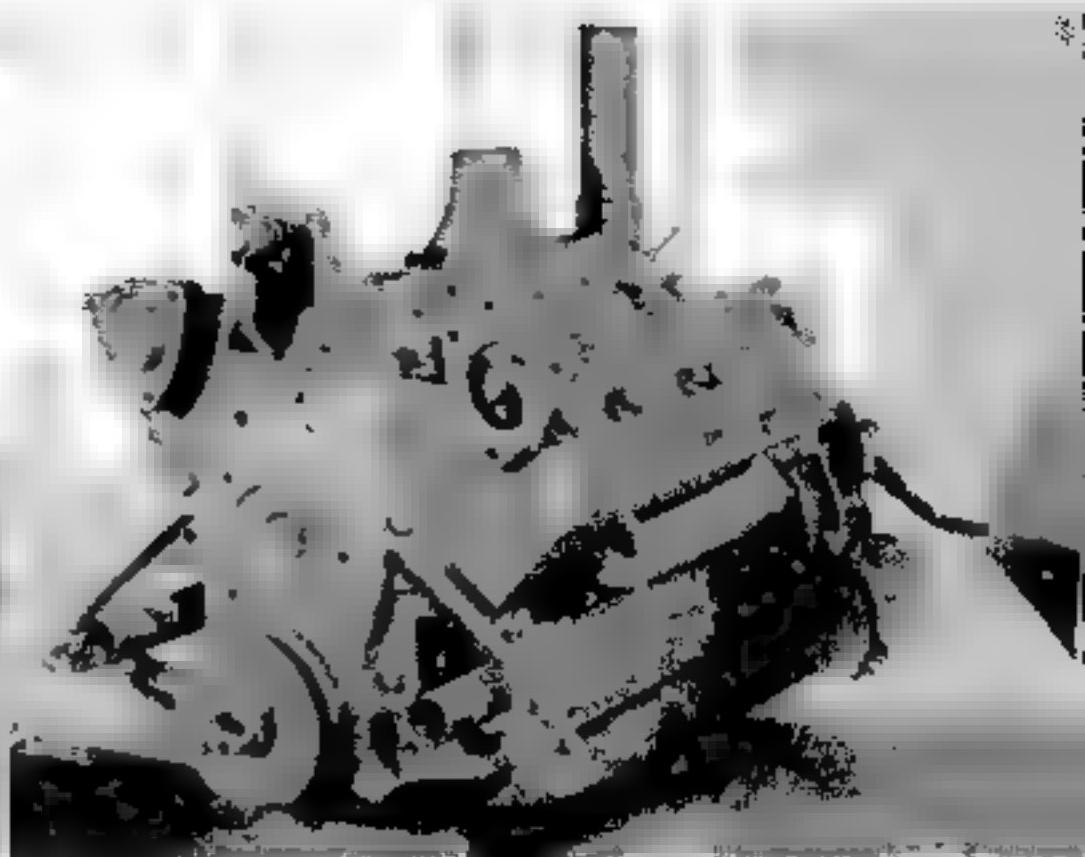
The X engines were not just a hobby



EXPERIMENTAL V-8 had cylinder heads like those that finally went into production in '32.

for Henry Ford. In 1926 an official engineering memo stated that "an X-engine car will replace the Model T." Even after work began on the Model A, Ford evidently regarded it as an interim model, meant to give him time to perfect the X engine. In 1926 he told Charlie Sorenson, the company's top production man, "We don't want to abandon the X-8s. That's something for the future. But we've got to design a four-cylinder car right now for the market."

More than a year later, continuing troubles with the X-8s convinced Ford they should be shelved. Manifolding was a problem, as was adequate lubrication. The exposed position of the lower plugs made them vulnerable. The high crankshaft position in the center of the engine called for high floors, and the trend to



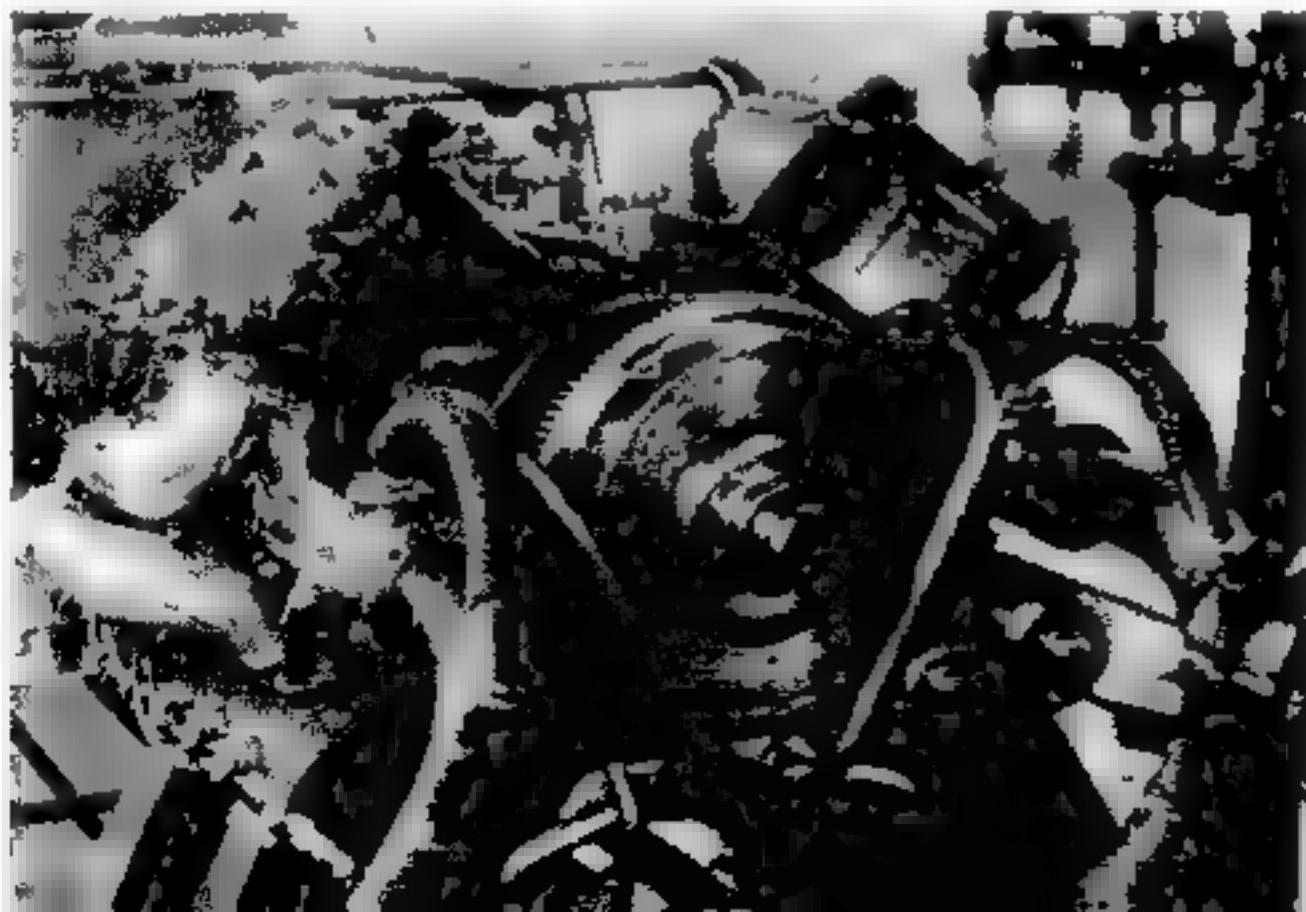
ANOTHER EARLY V-8 was almost the shape of the flathead engine later built by the millions.

ground-hugging cars had already begun.

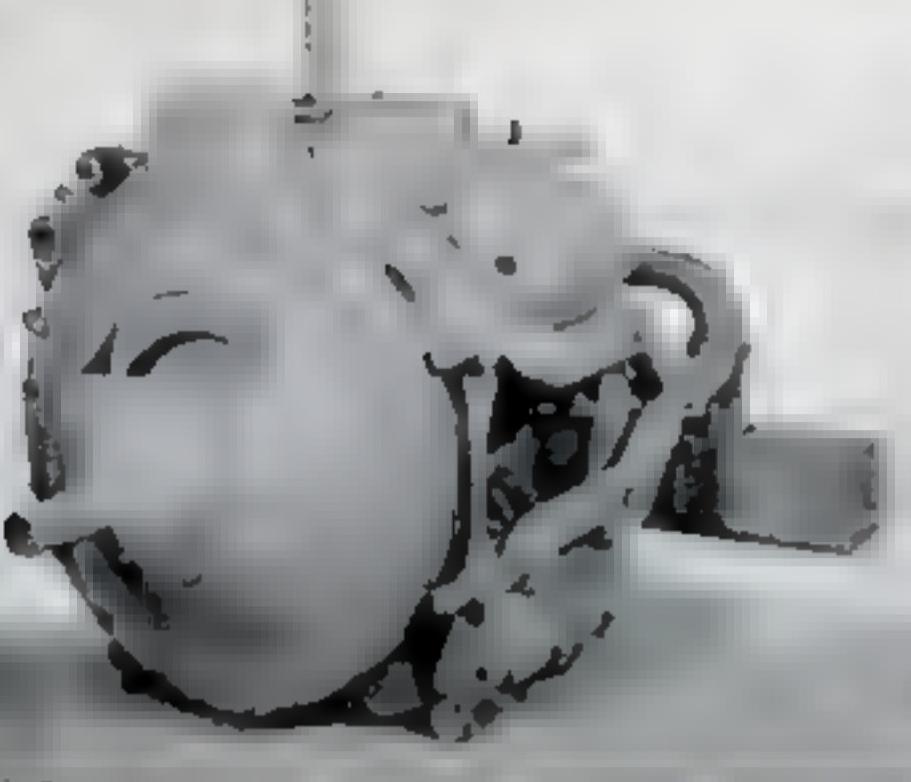
Ford had originally been attracted by the short crankshaft of the X-8. He had a phobia against long crankshafts, which was why he disliked in-line sixes and despised straight eights. So when the X-8s were shelved, the V-8 was his logical successor to the four.

But why not a V-6? They tried one, earlier. In June, 1924, L. S. Sheldrick, another engineer in Ford's experimental group, designed a V-6 and made full-scale blackboard layouts of it. The project died there, due mainly to anticipated balancing problems.

The first V-8s reflected another Ford phobia: They used splash rather than pressure lubrication. The old man regarded oil, fuel, and water pumps as unnecessary complications. When the



ONE LATE X-8 survives in Ford Museum. It shows evidence of much developmental work over earlier version on previous page, and probably dates from later Twenties. This may have been the engine that was adapted for trial in Edsel Ford's boat, since it is fitted with water-cooled exhaust manifolds and dual ignition systems.

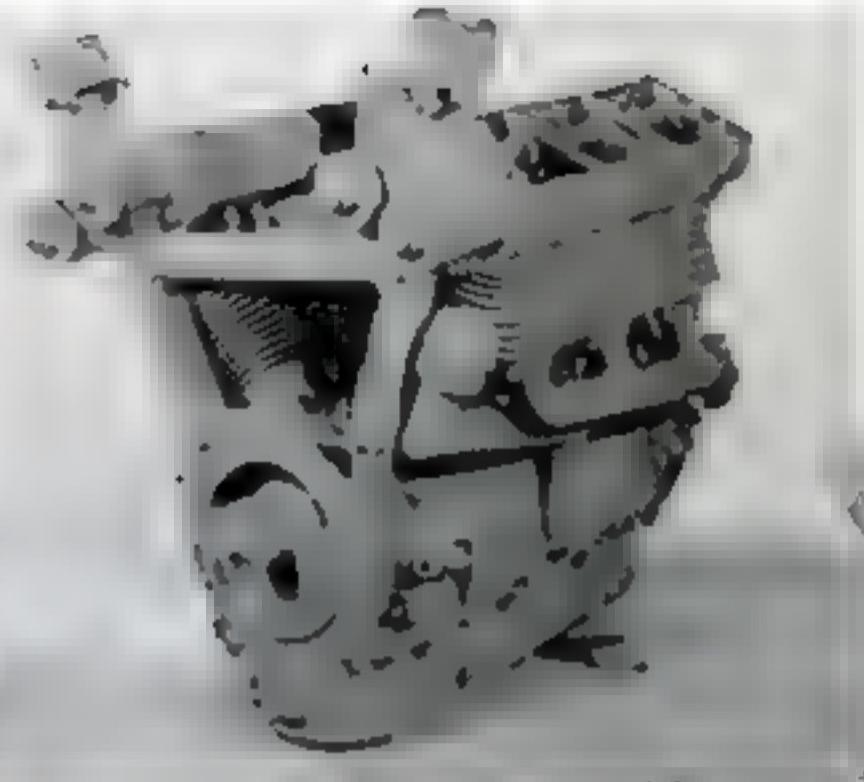


LATE X-8, just before the project was abandoned for passenger cars in 1927, was water-cooled.

first V-8 burned up on the dynamometer, his engineers managed to persuade him that pressure lubrication was needed. He held out longer against fuel pumps (both the Model T and A used gravity feed) though he permitted them on the first production V-8s.

In the 1930s aluminum caught Ford's eye. He didn't like dealing with, and perhaps making money for, what he called a "monopolistic trust." But aluminum's lightness and heat conductivity stirred his practical imagination. He put his team to work on a series of aluminum engines, both air- and water-cooled and with varied cylinder arrangements.

Like most of Ford's experimental engines, these aluminum power plants displayed many paradoxes. Advanced in many respects, they were archaic in oth-



AIR-COOLED V-12, built in mid-Thirties. It had dual overhead cams, weighed only 150 lb.

era. A prime example was an overhead-cam V-8 developed during the middle or late 1930s. (It's difficult to pinpoint the date of these projects; the experimental group operated informally and records are sketchy.)

Putting the camshafts in the cylinder heads so they operated the valves without push rods and rocker arms made for good breathing potential and high revving ability. Using aluminum alloy for the block and heads was another advanced idea. Yet a disregard for known combustion-chamber, valve, and carburetion designs nullified many of the engine's advantages.

The combustion chambers were poorly shaped, and the valves were small, with the exhaust bigger than the intake. A

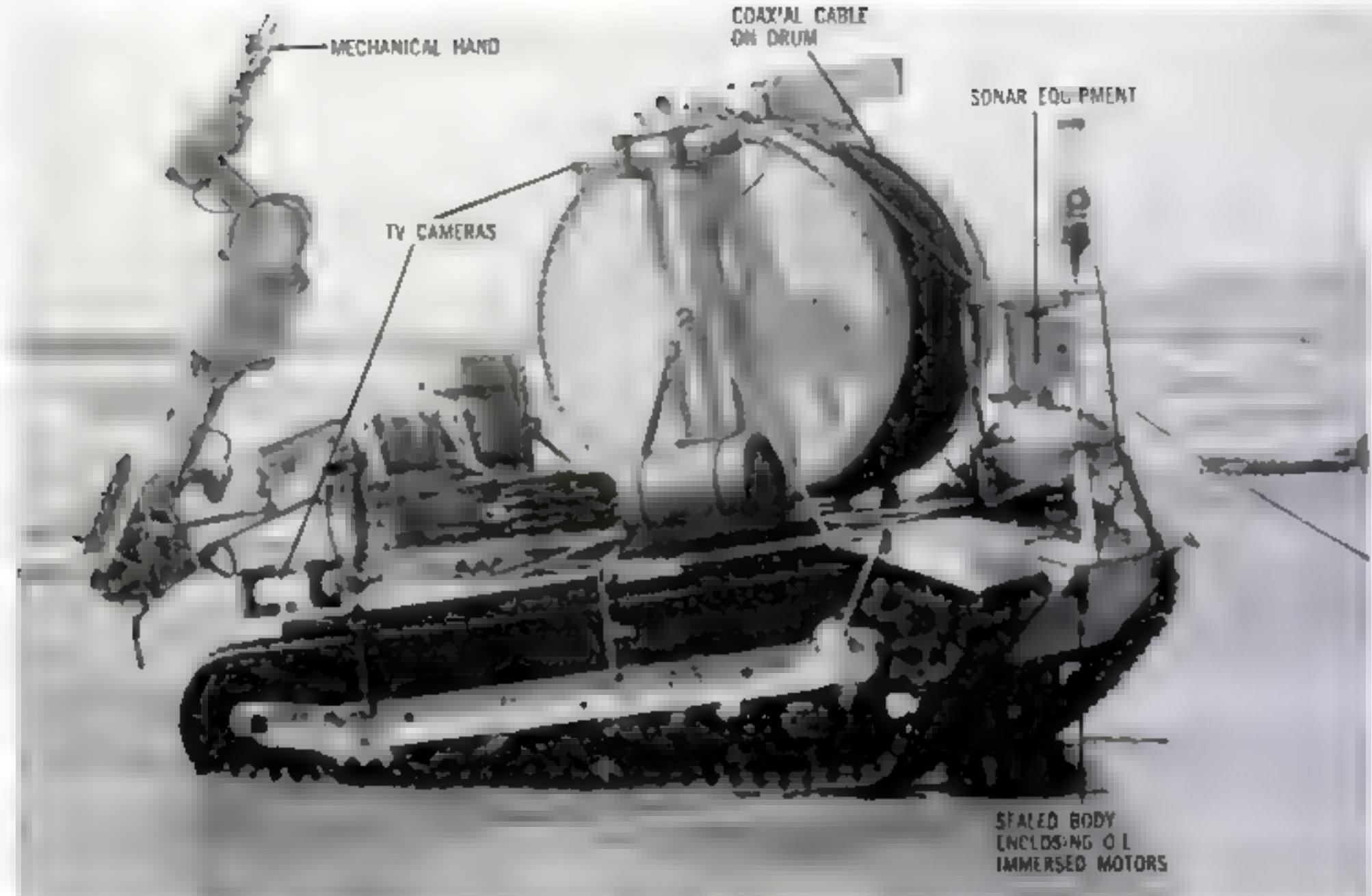
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Falcon's Forerunner Was Tested Out in 1949

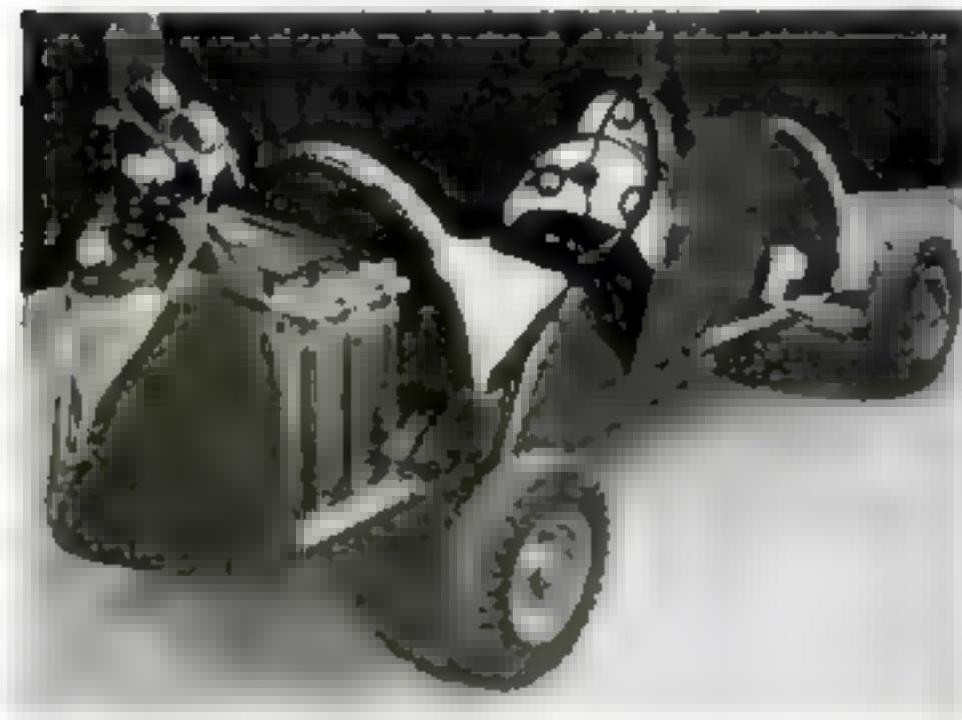


Never produced, but one of a series of experiments, the 106-inch-wheelbase handmade car at left was a predecessor of the compacts that arrived a decade later. This one was tested out at Ford's Dearborn proving grounds in 1949, probably with an in-line six-cylinder engine.

Earlier, during the war years, Ford experimented with a series of smaller cars, with wheelbases of around 98 inches. They were to be austere, cheap to buy and run, and powered by a radical, water-cooled, in-line five-cylinder engine—if it could be balanced adequately.

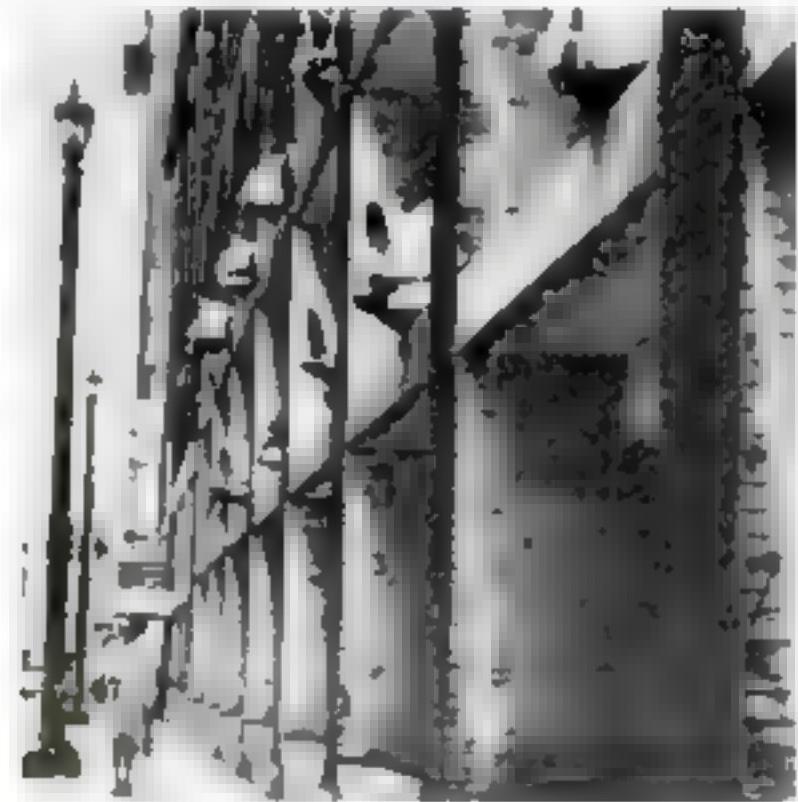


Down to the sea by remote control, complete with television, sonar, and a mechanical hand.



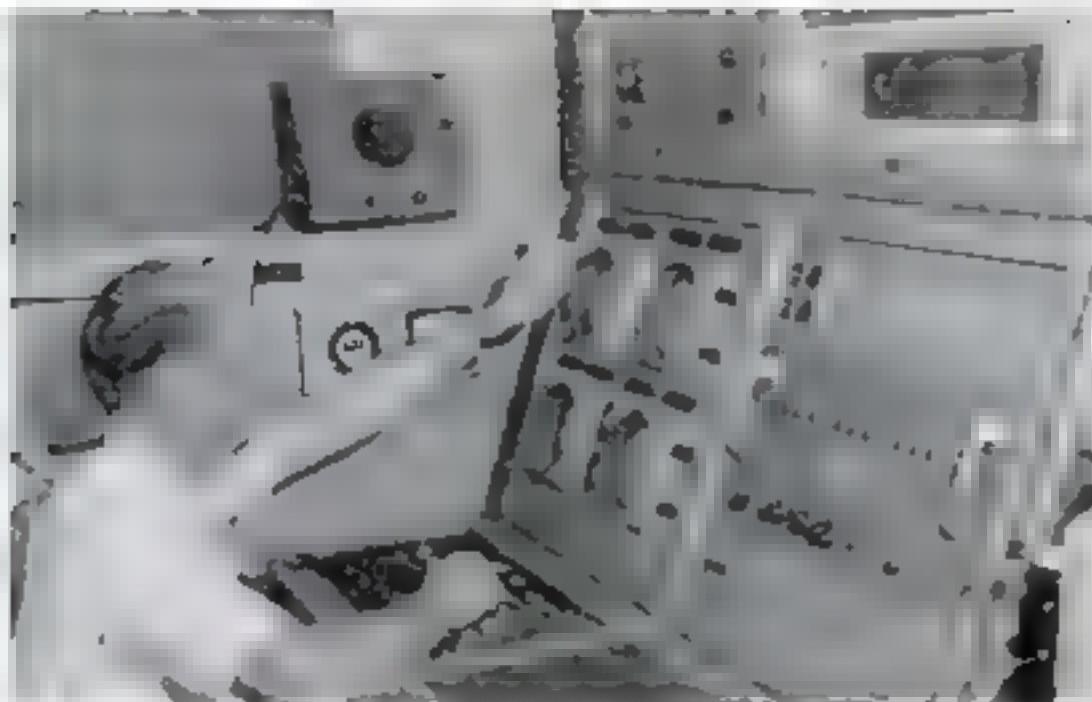
Electric racing car

The fuel cell powering this midget racer could lead to electric drive for your car. It's press agentry (top speed 10 m.p.h. on a starter motor), but the fuel cell is a serious experimental model that Exide is developing for factory lift trucks and the like. It makes juice when oxygen (from the tank) reacts with zinc plates in potassium hydroxide. It runs 16 hours, can then be recharged.



Bumper crop

That Detroit's creations are longer than ever is proved by the bevy of fins jutting from an open wall St. Louis garage. Though the situation looks menacing, passersby aren't concerned—the cars are secure behind low concrete walls.



Console has controls and four TV screens.



Control van is linked to RUM by cable.

Underwater robot to explore ocean floor

The Navy has added a robot hand, sonar, and four television cameras to a rebuilt Marine tank. RUM—for Remote Underwater Manipulator—is a sort of poor man's Solaris [PS, July]. Cost of the project: \$250,000. The interior of the tank has been sealed against water and filled with oil in which two 7½-hp. electric motors run immersed: one to move each of the two tracks.

The vehicle is linked to a mobile van on shore by a coaxial cable long enough

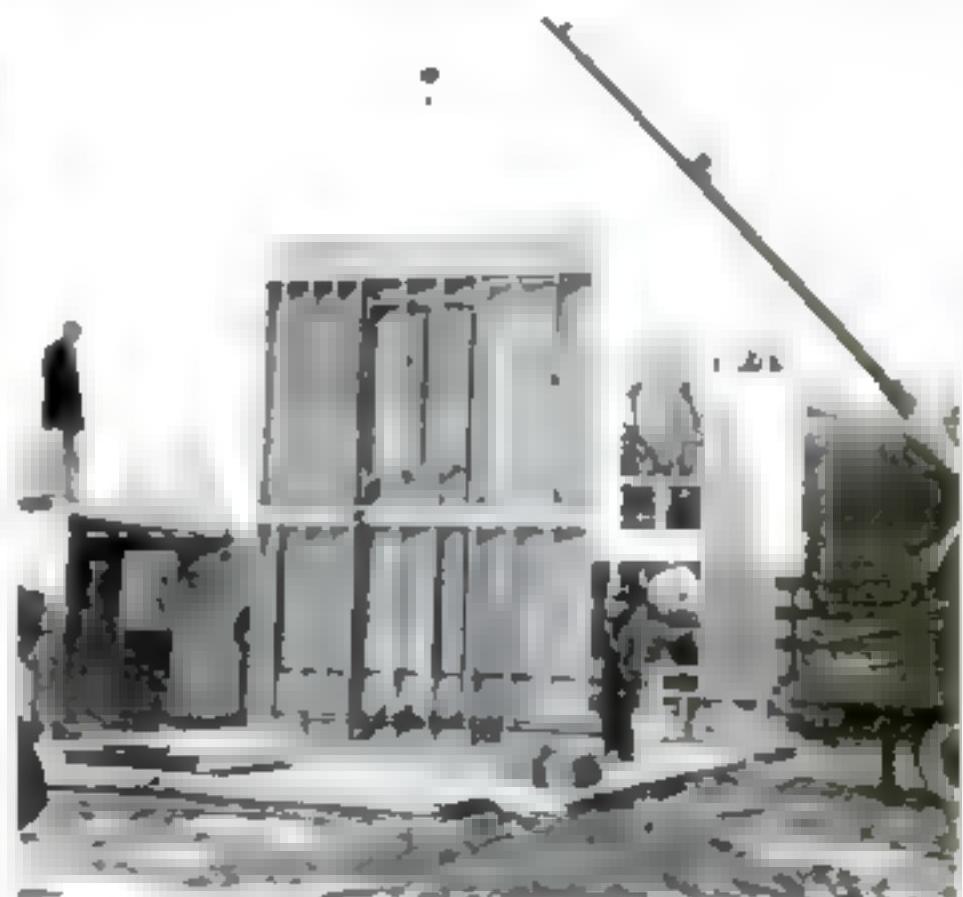
to permit operation five miles out and 20,000 feet under the sea. The cable carries power to the motors, TV cameras, mercury-vapor lamps that light the deeps for the cameras, telemetering channels, and a mechanical hand that can pick up objects ranging from a piece of kelp to a forecastle section.

Designs exist for a similar vehicle of aluminum. Future RUMs would weigh several thousand pounds less, says the Navy, and would be more reliable.



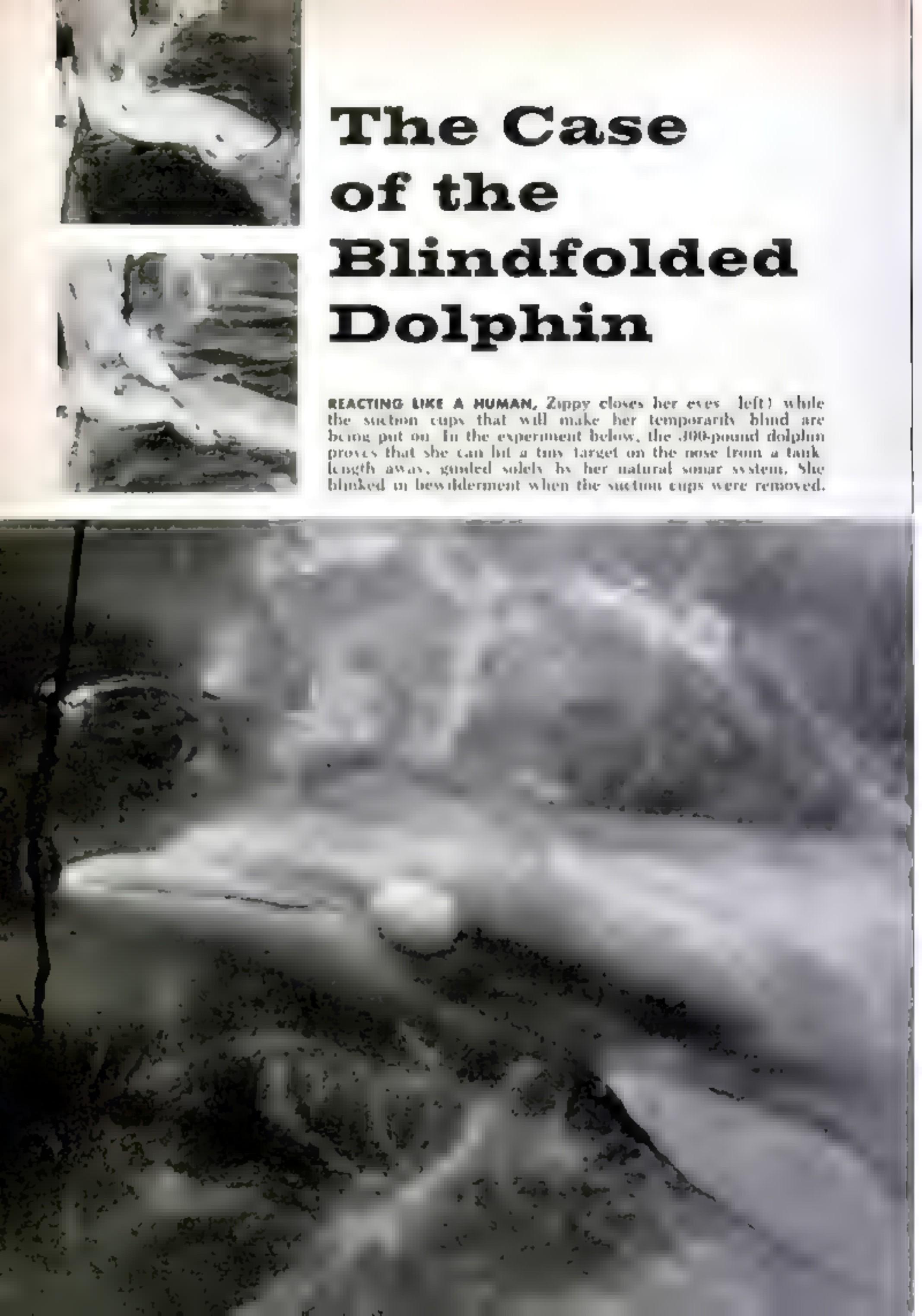
Electronic bartender

Just flick a switch and this German-built electronic machine will concoct the mixed drink of your choice. One drawback: Mechanized bartenders make poor listeners.



Prefabricated plumbing

This prefab plumbing wall with lightweight plastic piping allows immediate installation of kitchen and bathroom fixtures. Made of a Goodrich vinyl plastic, Geon, pipes withstand high temperature and resist corrosion.



The Case of the Blindfolded Dolphin

REACTING LIKE A HUMAN, Zippy closes her eyes (left) while the suction cups that will make her temporarily blind are being put on. In the experiment below, the 300-pound dolphin proves that she can hit a tiny target on the nose from a tank length away, guided solely by her natural sonar system. She blinked in bewilderment when the suction cups were removed.





WITH ARMS EXTENDED, Dr. Kenneth Norris, curator of Marineland, recalls his blindfolded

dolphin. When he slapped the surface, she swam straight to rest her head between his hands.

How a smart, obliging young sea mammal named Zippy helped a scientist prove that dolphins navigate by sonar

By Wesley S. Griswold

WHEN I first saw Zippy, she didn't look the least bit like a gal who has made a fascinating contribution to scientific knowledge.

She was behaving like a jittery actress waiting in the wings for an entrance cue. She swam in restless circles, and her breathing was a series of gusty sighs.

Zippy is a slim young bottle-nose dolphin, about five feet two, with eyes of brown. She's a sea mammal of infinite grace and dazzling speed, even though she weighs more than 300 pounds. She lives in a tank at Marineland of the Pacific, on a noble peninsula pointed toward Catalina Island, Calif. She is smart, prankish, emotional, and can do a lot of astonishing tricks. Her voice would break your heart, though. When she is invited to "sing," she sounds like a terrified baby.

But I hadn't come to Marineland to watch Zippy play water polo, leap through hoops, and blow a horn, or to hear her sing. I was there because I'd heard she had recently been swimming

blindfolded—yet as fast and as accurately as a torpedo. I wanted to find out how she had done it and why.

What Zippy had proved, I learned, was that dolphins and porpoises have a natural sonar system to help them navigate. In clear, sunlit water, they use both their sonar and their sight, which is sharp. In the dark, though, or in murky water by daylight, they find their way and their food entirely by uttering bursts of high-frequency sound and being guided by the echoes. This works with incredible precision, even when they are traveling at top speed, which is about 30 m.p.h. They are the fastest creatures in the sea.

The man who devised the experiments in which Zippy starred is Dr. Kenneth S. Norris, curator of Marineland. Norris is an amiable, witty zoologist who is 36 years old—10 times older than Zippy. In a relaxed manner, he described the discoveries they had made together.

First, though, he straightened me out on the difference between a dolphin and a porpoise. It seems there's very little.

"They're all small whales," Norris said,

When hunting food, porpoises emit sounds 140 times



AFTER AN 18-HOUR FLIGHT from Florida, Zippy, who had been kept moist in a wet blanket, is shown here as she arrived at Marineland last summer, before her sonar experiments began.



ZIPPY TAKES A BOW after collaring herself by zooming up through a floating rubber ring. She stands like this and swims by moving her tail up and down, not sideways as fish do.

"with big and complex brains. A true dolphin has conical teeth and a little snout. A true porpoise has spade-shaped teeth and a blunt head. But essentially they're the same animal. I call 'em all porpoises. There is less chance of confusion that way, for there's a fish called a dolphin, too, you know—not at all like the dolphins we're talking about."

What Zippy and he had done, Dr. Norris explained, was to put the finishing, conclusive touches on experiments that began several years ago in the East.

Artful dodgers. Scientists have long suspected that dolphins and porpoises have built-in sonar. The first clues came from the eerie skill with which they dodged nets stretched across escape routes from shallow estuaries of the ocean along the coasts of Florida, where they love to feed. From far off, even in water that was churned up and cloudy, these speedy mammals could detect a barrier in their path and avoid it. The smaller the mesh of the net, the easier it seemed to be for them to discover it. What worked best was a net with mesh a whopping 15-20 inches square. But that had to be thoroughly soaked first.

Researchers thought they knew why these curious facts were so. Small-mesh nets, they reasoned, made better sound reflectors than those with big openings in them. When a large-mesh net gave its presence away to an onrushing porpoise, it was invariably because the net had first been dried out in the sun. When it was submerged, air bubbles were trapped in the strands. The bubbles acted as resonators, making the net stand out like a picket fence to a porpoise using sonar.

So much for deduction. Seeking proof, in 1951 William Schevill and his wife Barbara, from the Oceanographic Institute at Woods Hole, Mass., learned a lot from a porpoise in a very muddy pool. The water was so opaque that there was little chance that the mammal could see beyond the end of its nose. Yet, whenever a fish was tossed into the pool, even at the far end, the porpoise got it fast.

Porpoise talk. The Schevills taught their captive to hunt for food whenever they rang a bell. By lowering mikes into the water, they discovered that when the porpoise was merely loitering around the

higher than the highest note a human ever screeched



AFTER CONTRIBUTING TO SCIENCE. Zippy (head above water) joins a fast game of marine basketball, where blindfolds are barred. That apparent dent in her head is where she breathes.

pool, it made a high-pitched, wavering squeal, like an elfin siren. The instant the bell rang, however, this wobbling squeal changed to short bursts of noise resembling the creaking of a rusty hinge. These lasted while the porpoise hunted. As soon as it found the fish, it resumed its squeal.

Dr. Winthrop Kellogg and colleagues at Florida State University went further. They took the porpoises' rusty-hinge sounds apart, and found they contained frequencies far above the range of human hearing. The highest note a very young person can hear is around 20,000 cycles.

The Schevills discovered that the hunting sounds of a porpoise soared up to 196,000 cycles, a frequency 140 times higher than that of the highest note a human being ever screeched. They also found that a porpoise could hear perfectly up to 100,000 cycles, and would react to sounds as high as 150,000 cycles.

These various researchers then built complicated mazes for their respective porpoises. Even in the cloudiest pool, and at night, the animals had no trouble finding their way to the food that awaited them at the end of the maze.

All this seemed pretty conclusive, but Dr. Norris, out at Marineland, was both-



WHERE ZIPPY DOES INTO HER ACT: Aerial view of California's Marineland of the Pacific shows the three-ring sea circus in which the talented porpoise plays a starring aquatic role.

erred by one flaw. In every experiment, the porpoise had had the use of its keen eyes. He felt there was still the chance that in the last few inches of the hunt, it had been guided by its vision.

So he decided to blindfold one of the animals, if possible, and prove conclusively whether or not sonar was doing the trick all by itself.

Enter Zippy. Zippy came in by way of an 18-hour flight from Florida in a cargo plane last summer. She rode suspended on a stretcher and covered by a wet blanket. Occasionally, en route, she was turned over, to prevent her from getting cramps in her flippers. Zippy was then only about 2½ years old.

"You want a young animal for training," Dr. Norris told me. "They're much more adaptable than the old folks. We hadn't deliberately picked a female. Both male and female porpoises are fine to work with."

Zippy had been taught a few elements at Marine Studios, St. Augustine, Fla. That helped. Still, it took four months of daily sessions to get her to wear blinders, something no member of her species had ever worn before.

"We tied it all in with feeding," Dr.

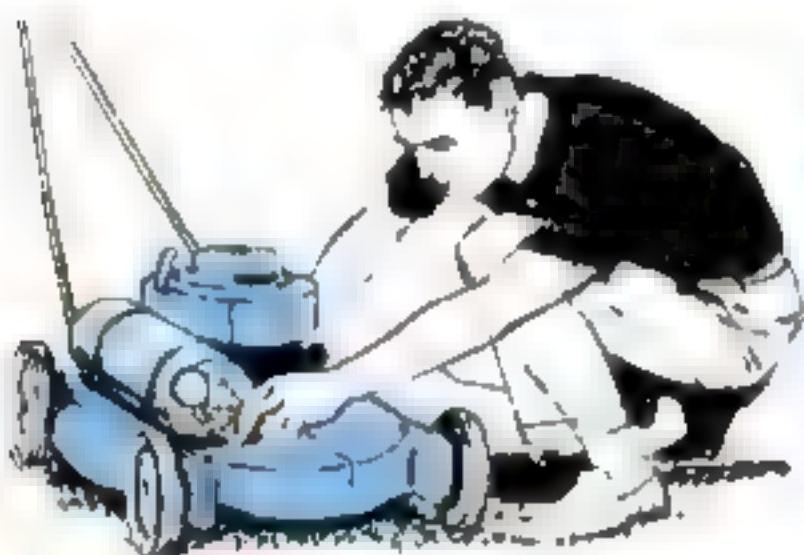
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"I'd like to see them make..."



PATIO FURNITURE FOR SMOKERS. Pull-out ash trays could be inserted in the aprons of tables,

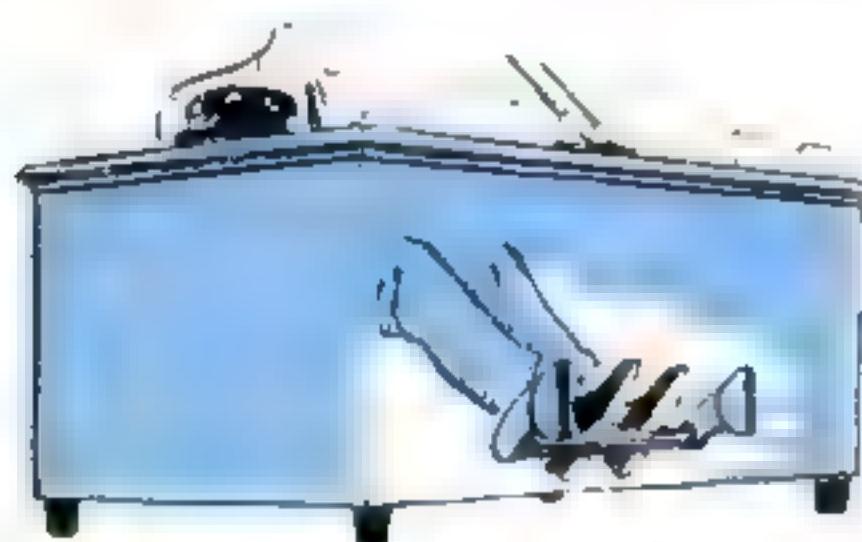
and well holes could be opened in the arms of chairs.—Katherine Riggan, Leola, Ark.



A MOWER RUN ON BOTTLED GAS for better starting (no carburetor troubles, no carbon deposits) and once-a-season oil changing (reduced crank-case dilution).—S. Gilley, Terre Haute, Ind.



A BUILT-IN BOTTLE OPENER on refrigerators. Since that's where the cold drinks are kept, why not have an opener handy, inset in the door?—MayBelle Schouz, The Dalles, Ore.



ADJUSTABLE FOOT RESTS on all office desks. A swing-down bar like that on trains could have notches for the sidepieces to adapt them for long or short legs.—F. A. Casey, NYC.



RECESSED CARGO HOOKS in station wagons. Then you could lash down cargo to prevent it from shifting and sliding on turns or in hilly country.—D. F. Hammond, Alexandria, Va.

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by Popular Science readers. What's yours?

We will pay \$5 for each one published. Please use Government postcard reply. Write name and address clearly. Contributions cannot be acknowledged or returned.



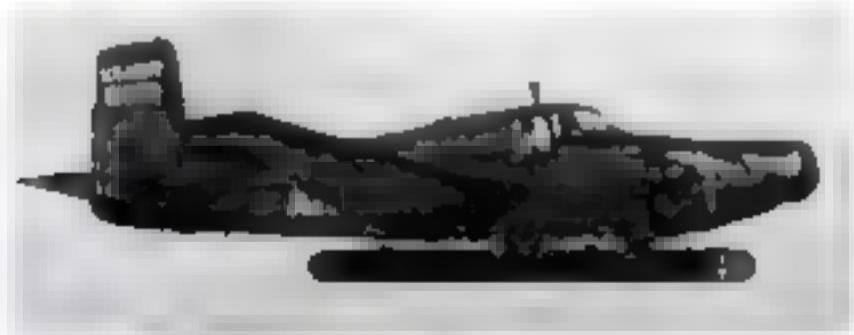
Coffee belt takes Java to the cup

A new automatic coffee machine turns out freshly made coffee by the cup. It's a German invention for restaurants.

A conveyor belt runs measured amounts of pulverized coffee between a steam supply and a cup-filling tube. A hexagonal pulley drives the belt to keep a constant supply of makings.

Side-viewing radar

The Army has a new airborne radar that looks to the side—and takes high-resolution photographs of what it sees. A plane carrying the equipment could fly along a border and bring back pictures of military installations without violating an enemy's territory. The system sends out radar pulses and records their return on film. Equipment that interprets and processes the signals into map-like photos rides in a ground van.



SIDE-LOOKING RADAR is mounted here under the fuselage of an Army L-23D. In actual use the radar is housed in a streamlined radome.



A crew of two runs the comfortable, low-riding boat.



Fair Lady's long conference table seats 20 persons.

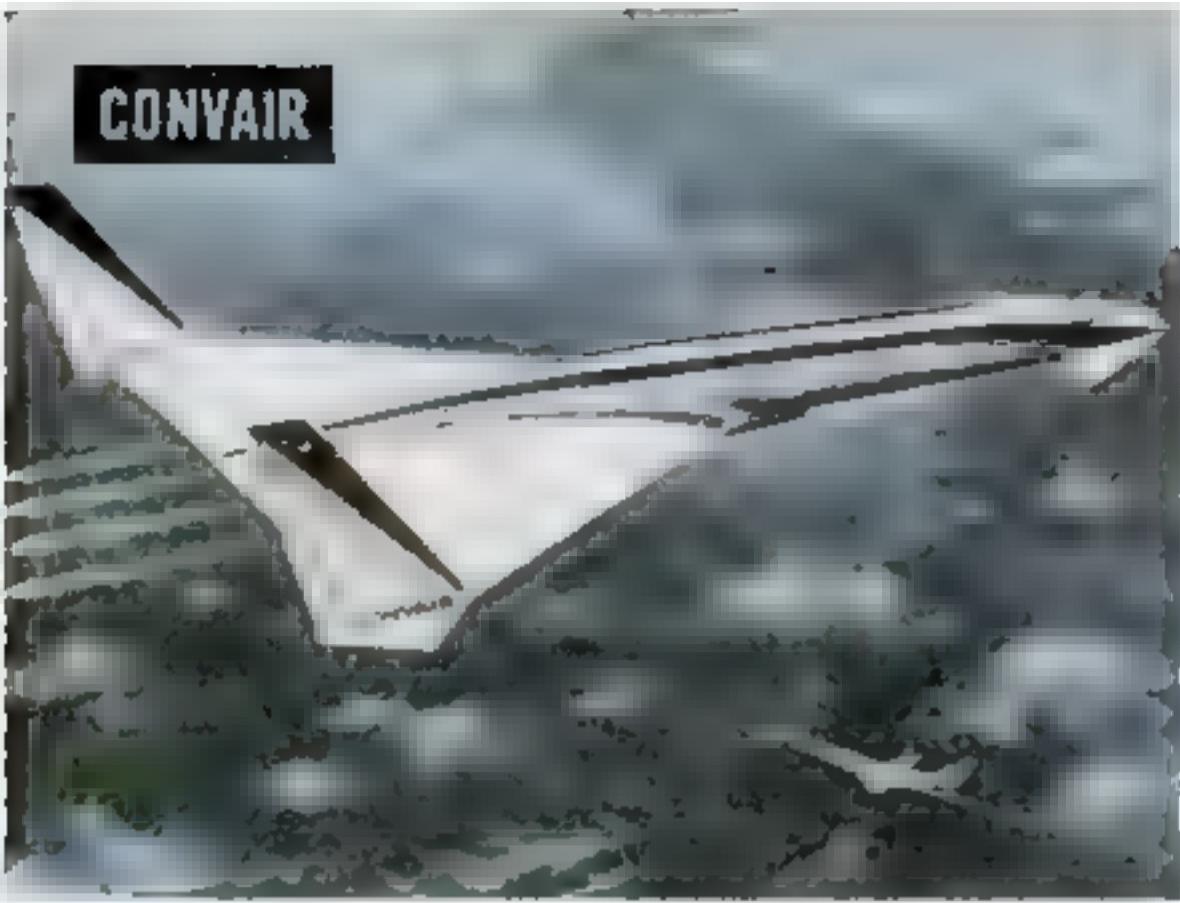
Here's real salesman ship

Designed for business conferences and cocktail and dinner parties, the luxury cruiser Fair Lady operates on inland waterways in and near London. The craft can be rented for \$140 a day.

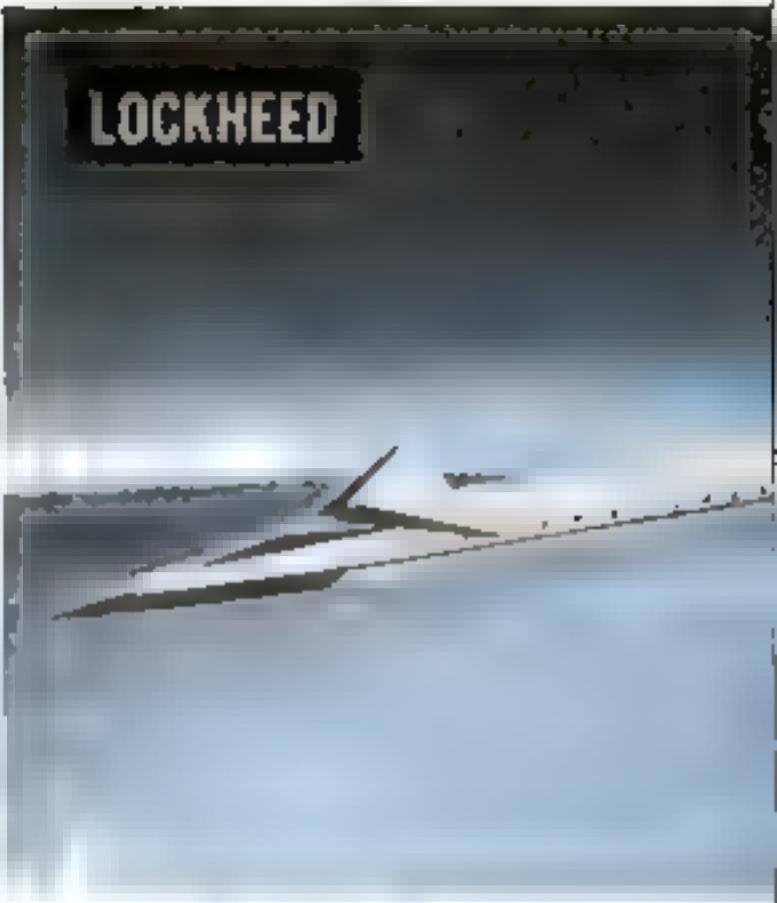


MAP OF WASHINGTON AREA was photographed from miles away. The unfinished bridge at center is under construction over the Potomac.

CONVAIR



LOCKHEED



One of these designs by three leading U.S. aircraft builders may be the shape of supersonic

Tomorrow's jetliners, cruising at 2,000 m.p.h., will streak—

Coast to Coast in 80 Minutes

By Elliot Tozer

IF YOU have ever watched the F-106 Delta Dart shoot straight up, like an arrowhead on a shaft of exhaust flame, you know how tomorrow's airliner will get up and go. Long, lean, and finned with knife-point wings, the new supersonic airliner will blast off almost like a missile.

Commanding 120,000 pounds of thrust, it will climb to 38,000 feet at a no-sonic-boom 350 m.p.h., level off briefly, then really start climbing—at 600 m.p.h. At

cruising altitude, 70,000 feet, it will settle down to business at a glowing 2,000 m.p.h. Short minutes later, if it's on a coast-to-coast hop, it will dagger downward at 350 m.p.h.

Time from New York to Los Angeles: 80 minutes.

It's true that no such bird exists today. There probably won't be one ready to fly before 1963. And FAA approval may take another two years. But the supersonic airliner is far more than a doodle on a designer's scratch-pad. Lockheed has been holding skull sessions with U.S.

Cutaway view of Convair's supersonic jetliner

Key features of Mach III plane

- Windows heavily tinted up to 3 against transonic
- generate difference 23 miles per hour

Four jet engines each in the 50,000-lb. class; Pratt & Whitney J58s. Thrust delivered 120,000 lb. thrust at 600 m.p.h.

For article featuring Convair's supersonic jetliner see next to page 20 driving stock

NORTH AMERICAN

airliners to come—in five years or less. World leadership in commercial aviation is the prize.

airlines for the past two years. North American, prime contractor on the supersonic B-70, has piled up 14,000 hours of Mach 3 (three times the speed of sound) wind-tunnel time. Convair is studying design limits of a supersonic plane and its automatic systems. The British Ministry of Aviation this spring awarded Mach 3 study contracts to Hawker Siddeley and Rolls-Royce. Russia is well into actual construction.

The big race—with world leadership in commercial aviation for the next several years as the prize—is thus already half run. Here, based on unclassified reports from Lockheed and North American, is how our entry is shaping up.

Basically, it's a missile with portholes: long and very slender with stubby dart wings well aft where the tail should be. Its tiny tail is forward, like the tails on the Rascal and Hound Dog missiles. It's

clean and lean as a whippet, all "go."

But even though it's a missile-with-men-in-it, it's a surprisingly simple machine—and a logical extension of today's subsonic jets rather than a breakthrough. In fact, the engineers are finding the supersonic airliner a kind of grab bag of surprises.

For example, it's not a giant, a sky hog. It is small and trim, smaller than any other jetliner. Probable number of passengers: 90, compared to the Boeing 707 Intercontinental's 170.

The reason is simple: Its incredible speed gives it three times the airlift of today's jets—so much airlift, in fact, that it would lift itself right out of the market if it got much bigger. Not many routes generate enough traffic to fill the equivalent of a 400-passenger airliner.

And it doesn't need eight, or even six

[Continued on page 190]

Steel-and-aluminum fuselage.
Minimum levels to go with
Mach speeds above Mach 2.4.

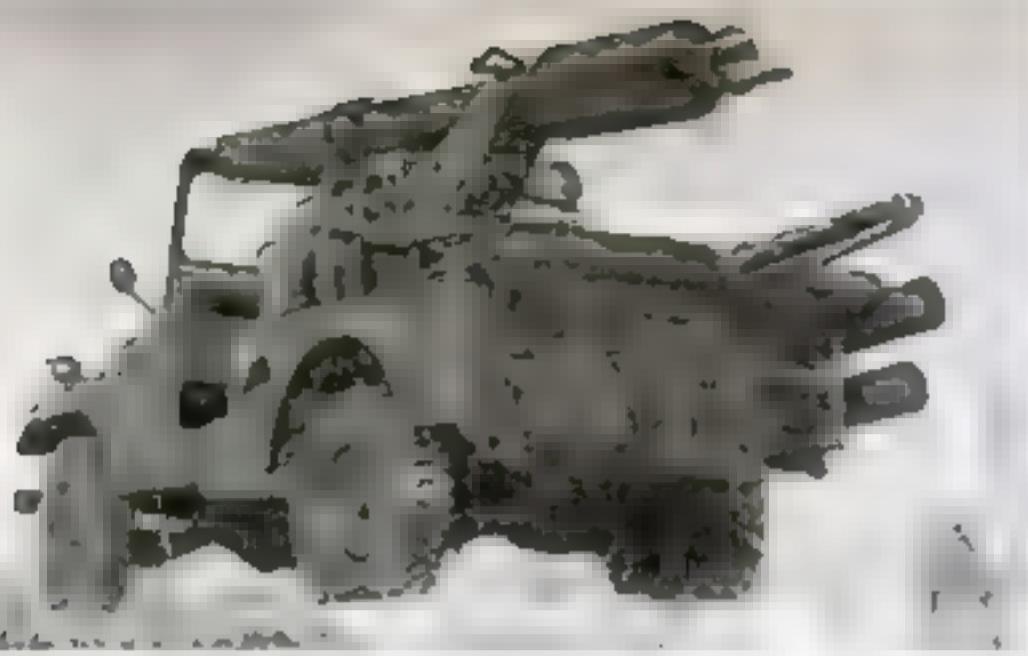
Electronic computers do most of the
"flying"—speeds are too high for human
reaction to conventional instruments.

Pilot barrel retracts
when plane hits top speed.



Seats for about 90 passengers—well
forward away from screen of engine.

Ducts carry moving air through
double walls of cabin to control
heat generated by Mach 3 airflow.



Long-range Davy Crockett is mounted in jeep . . . foot-soldier version fired from tripod.

Two-man atomic launcher

The Army's new Davy Crockett weapon system can put a nuclear warhead into enemy positions right from the battle line. Firepower, equivalent to that from

heavy artillery, is said to dwarf anything so far known for use close to enemy lines. The weapon can be transported and fired by two men on foot or in a jeep. Both versions work alike, but the jeep-mounted one has a longer range.



Display sign works on gas

A return to the gaslight era may be in store, judging by the gas-operated display sign at left. Consisting basically of two white, frosted glass panels that bear the advertiser's message, a steel frame, and a row of gas burners inside, the sign provides illumination comparable to that of an electric display of corresponding size. The maker is Arkla Air Condition Corp., Little Rock, Ark.



Kerosene is poured from drums over water in the tank . . .

. . . and then set on fire to

Ordeal by fire seeks to protect men at sea

Attempting to find ways to save the lives of sailors forced to abandon a burning tanker surrounded by a sea of blazing oil, the British Admiralty and Min-



Registering by TV

Two-way closed-circuit television in the 500-car garage of San Francisco's Jack Tar Hotel enables guests to discuss accommodations with the desk clerk upstairs. He lights up a floor plan so guests can choose among vacant rooms. Keys are delivered via pneumatic tube. Check-out is also televised.



Europe's craziest house

This house, according to legend, was designed with no two rooms alike and intended by the architect to be the tallest in Hagenbuchach, Germany. Soon after it was built, a taller one sprang up. So the architect added another house on top. Today the piggyback dwelling is a home for aged. Problem for the old folk: climbing all those stairs.



blaze away furiously.



The tarp comes through unscathed; there's a hole in the boat.

istry of Transport are testing a number of heat-resisting materials for both life-boats and their protective canopies. The fire test shown here was conducted in an

outdoor tank at Portsmouth, England. The tarpaulin came through the trial unharmed, but a hole was burned in the bow of the aluminum-hulled lifeboat.

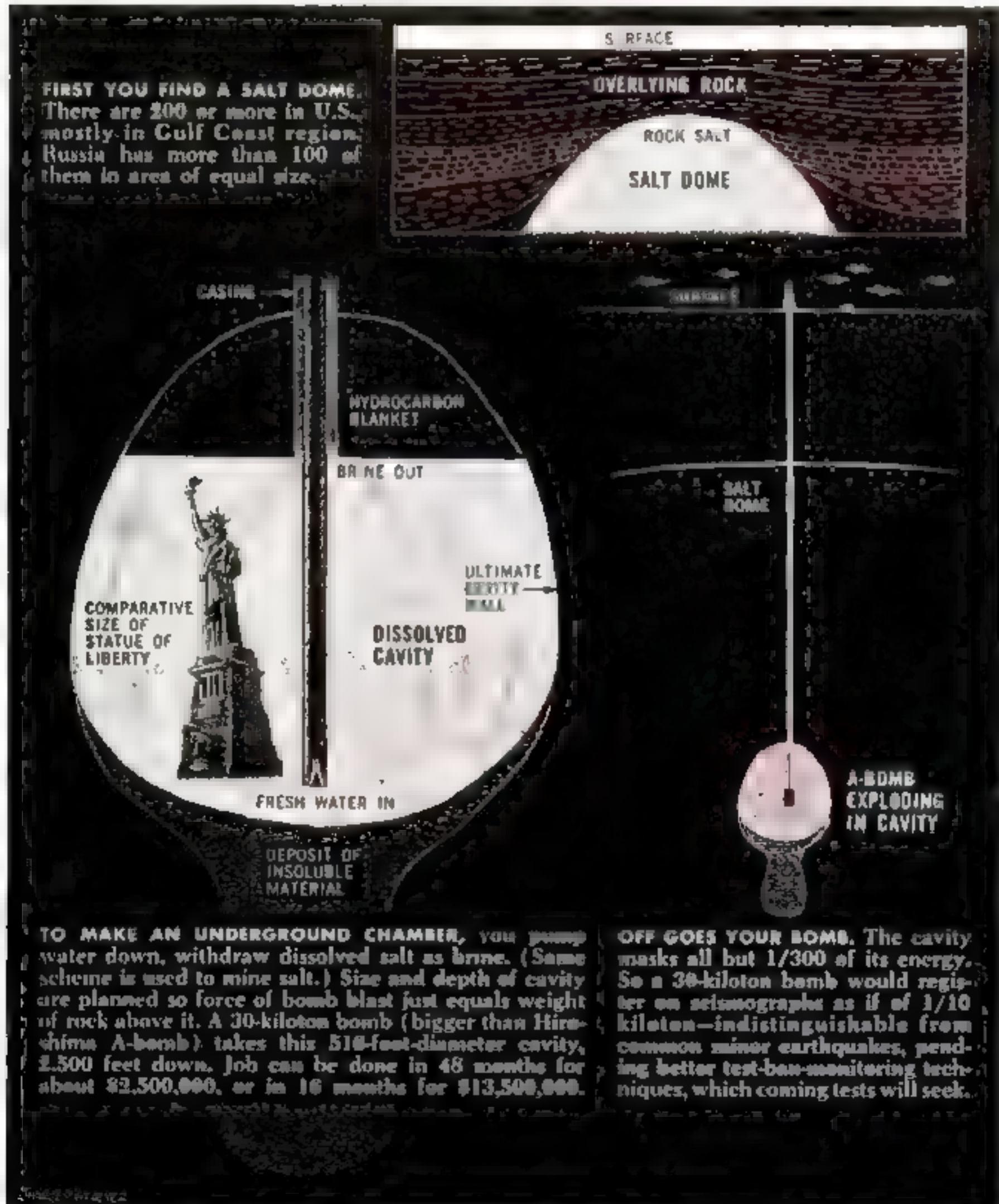
How to Hide an A-Bomb Test

DISCOVERY of a new way to conceal nuclear-bomb tests has jolted tentative plans for banning them.

Set off in a huge underground chamber, an A-blast can be made to seem 300 times smaller, and seismographs can't tell it from a minor earthquake. The

trick of "decoupling" or muffling it is to balance its force with the weight of overlying rock, which will then be shaken comparatively gently. So Dr. Albert R. Latter, Rand Corp. atomic scientist, recently calculated. Chemical explosions in a Louisiana salt mine tested his startling theory and proved him right.

A bomb-hiding chamber would take no excavating, Dr. Latter says. It could be made simply by dissolving part of a salt dome with water, as pictured here.





Russian owner of this car was plainly apprehensive as the writer photographed it.

It's Tough to Buy a Car in Russia

**Ivan must pay through the nose,
wait interminably, unwind miles
of Red tape to get an auto**

By Harry Walton

BACK in Vladivostok after his visit to the U.S.A. last fall, Premier Khrushchev said in effect: "America has awful highway jams, yet many cars carry only one person, a great waste. We will build more cars too, but for taxi



Instead of cars, fenders and replacement doors fill part of the display floor of the marble-walled Moscow auto shop. In another part of the same store (above, right) you can buy a new engine, rear axle, or frame.

CONTINUED



Curb-side mechanics change a wheel bearing outside the store. Cars lined up here are often for private sale, but fast-buck turn-over of a newly bought one is illegal.

service. The Soviet citizen who wants to go somewhere will simply call a cab."

A friendly young Russian in Moscow told me this the day it was reported in *Pravda*, "We laughed over it all morning at the Institute," he added.

It was typically wry Soviet humor, for Ivan yearns for a car all his own. He also knows that it's little more than a dream. True, the Soviets are boosting auto production (after long emphasis on trucks). New automobiles are being delivered every day. State planners have even come to realize that bright colors cost little more than drab black or sickly tan; the auto scene is much more colorful than it was on my first visit late in 1957.

How does this affect Ivan's dream? Who can buy a car in the car-hungry Soviet Union, and where, and how? What about service, trade-ins, resale? I had 31 days to find out. Sometimes the unofficial answers were the most interesting.

The Russian crowds that flock around any car driven by a visitor from the West—whether it's an American, German, English, French, or other make—are living evidence of the Soviet citizen's enormous interest in automobiles. State officials

recognize it by making a small Moskvitch sedan the top prize in government lotteries, with such capitalistic goodies as pianos, refrigerators, and sewing machines as lesser prizes.

A subtler, backhanded tip is the paper you must sign on driving into the U.S.S.R. In it, you promise not to sell your car in the Soviet Union.

I don't know what would happen if a foreigner reneged on this. But when I parked near the big auto shop on Dakuninskaya Street in Moscow and strolled around the corner and back, a dark, bare-headed young man managed to be in both places at about the same time.

"He's a pirate (plainclothesman)," my unofficial Russian guide told me. "Thinks you'll try to sell your car."

If so, this eager beaver was disappointed. I had every intention of driving back to Paris in the Simca that had brought James Pinkerton, my traveling companion, and me to Russia. I had come to this street only to see a Soviet auto store.

Indoors, it looked like a pretentious but run-down bank selling fenders as a sideline. They were stacked up, along

with Pobeda door panels, in front of big marble columns and marble-paneled walls. Under great floor-to-ceiling windows stood a phalanx of new engines, rear ends, and chassis frames.

The place was crowded, as all stores in the Soviet Union seem to be. At one long counter a cluster of men vied for the attention of a pretty blonde, but only to buy small auto parts and accessories. Free travel folders, but no road maps, lay on a counter. At a desk two girl clerks registered would-be car buyers.

There wasn't a car in the place. Soviet auto stores aren't showrooms, perhaps for the excellent reason that cars are still in too short supply to waste as window dressing.

"A demonstration ride, comrade? But why? You see these cars on the streets. You may inspect them inside and out at the industrial exhibits. Please step aside if you do not wish to register."

From the manager of this store, an elderly man wearing a business suit with several military decorations, I learned that about 20 private buyers take delivery of their cars here every day. The store delivers 40 to 50 cars daily, the others probably for official or taxi use. Ships from the huge auto plant in Gorki, 250 miles east of Moscow, deliver 300 Volgas (the medium-size Soviet car) at a time.

To get on the buyers' list, Ivan must show his internal passport (everybody carries one in the Soviet Union) to prove he is a Moscow resident. ("From Lenigrad, Comrade? Then go there to register.")

Once registered, the buyer is in for a wait-up to two years, depending on car output and how many preferred customers squeeze in ahead.

What makes and models can Ivan choose from? The Pobeda is a has-been; it survives most conspicuously in the form of rattling taxis with groaning transmissions. Since 1957, production has focused on the little Moskvitch, the compact Volga, and (late in 1958) the big, showy Chaika.

The four-passenger Moskvitch has an 83-cubic-inch overhead-valve engine with low (7:1) compression. It develops 45 hp. at 4,500 r.p.m. On a 93-inch wheelbase, and weighing 2,000 lb., this four-

[Continued on page 186]



A shawled salesgirl dispenses motorcycle and scooter parts in Kiev, chief city of the Ukraine. The auto-parts counters were more crowded.



Customers flock around this blonde selling parts for the outmoded Pobeda. But replacement parts are not plentiful for the newer cars.

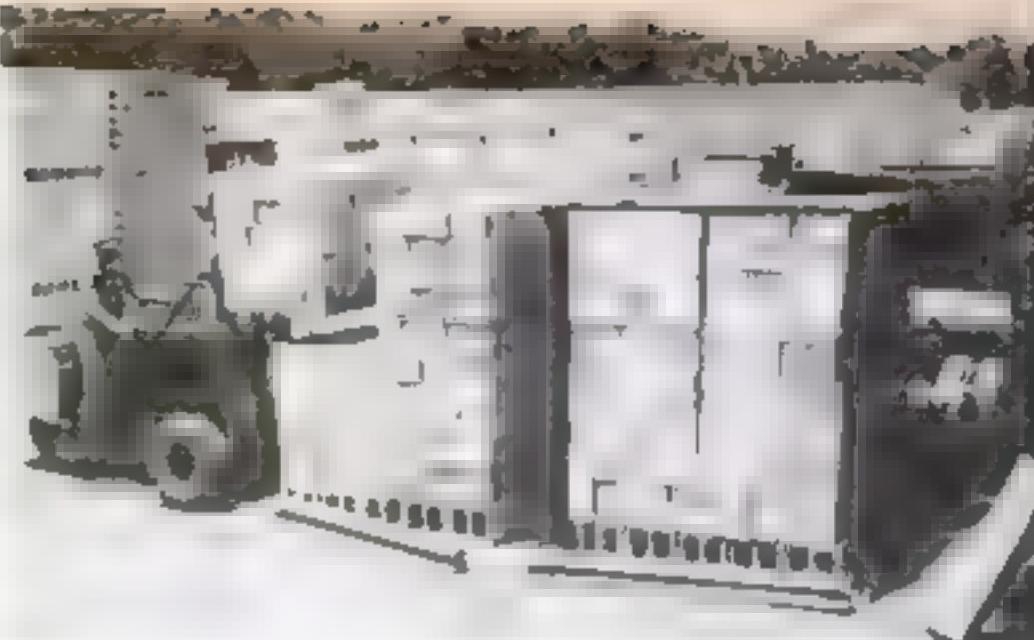


Three-wheeled cars like this one on a Simferopol street are free to disabled veterans, a good buy to others at 4,700 rubles (\$470).

Tandem hauler splits its load

Here's a truck that carries its load of cement blocks or bricks in two bodies. It picks up at the yard, makes delivery at different sites: one body load to each of two places or, by use of dividers, split loads to even more places.

Each body has three sides held together at the back by a hydraulic clamp. One at a time, the bodies are lifted and slid into place on the chassis by hydraulic cylinders. Unloading is in reverse. The truck is called a Pack-Hauler. American Truck Body Co., Martinsville, Va., makes it.



1. BLOCKS ARE STACKED in position to be picked up by the Pack-Hauler. On the ground are lightweight-aluminum clamp bars.



3. UPSY-DAISY. First section is lifted by a hydraulic-cylinder hoist. Other hydraulic cylinders then slide it forward on the chassis.



4. REAR SECTION is next lifted into place on the truck. Steel hooks at the bottom of its front end attach it to the forward body.



Survival gun in civilian version.

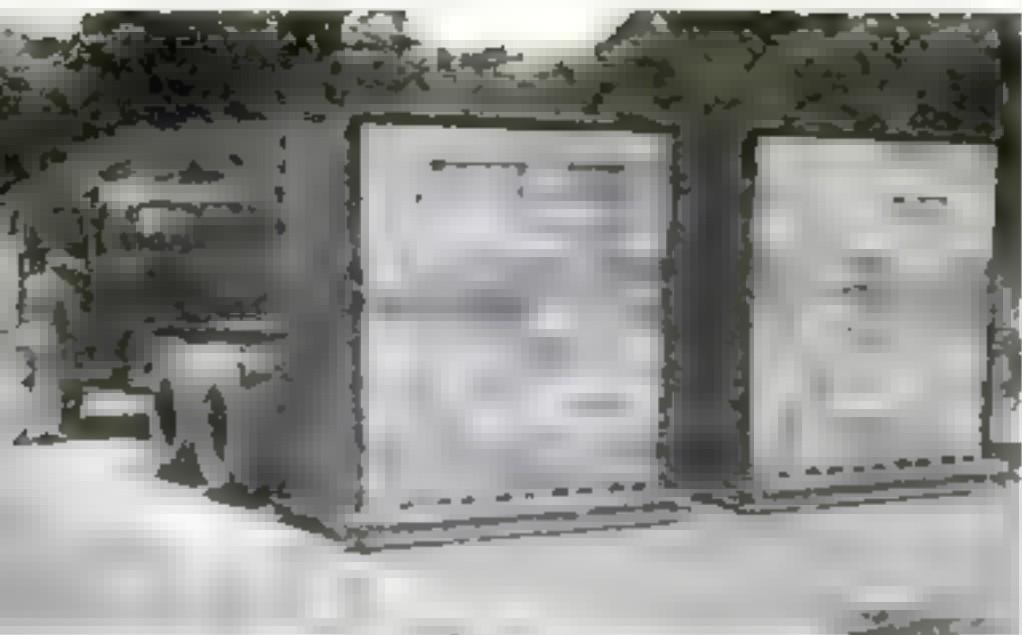


Barrel, action, and magazine are stored in the stock.

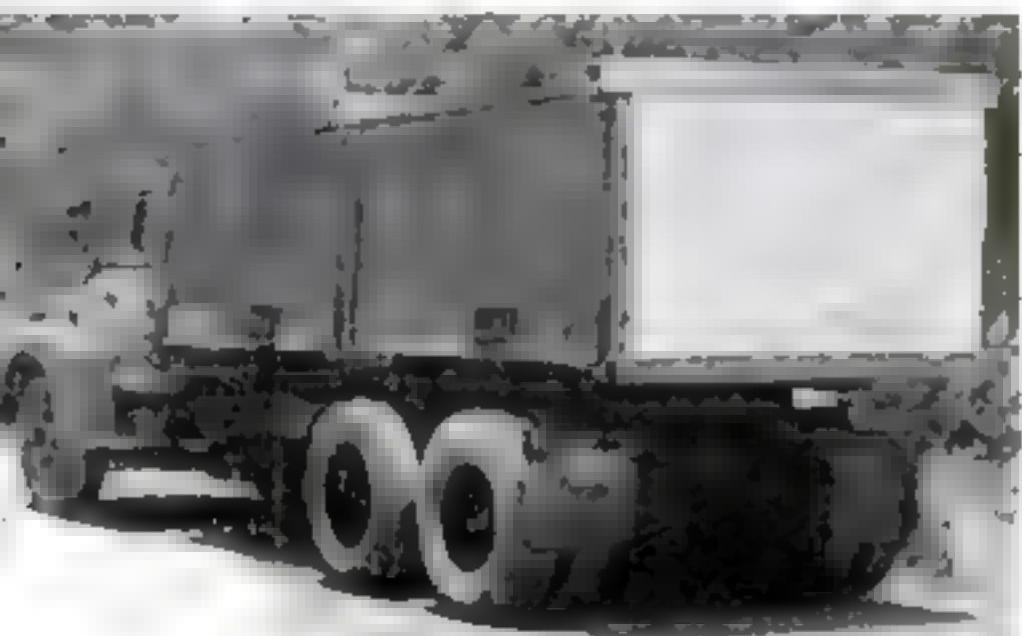
Stock swallows its rifle

Developed originally as Air Force equipment, Fairchild's Armalite survival gun is now made in a civilian version. Its 16-inch detachable barrel and action

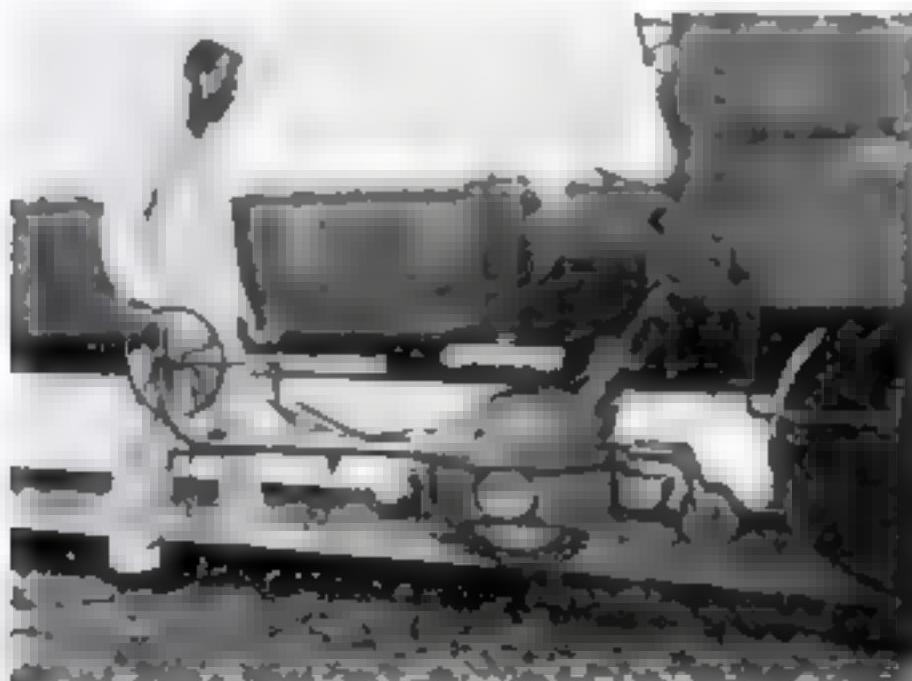
can be dismantled and stored with an eight-round magazine in its own hollow fiber glass stock for carrying in a duffel bag or bedroll. The .22-caliber hunting rifle is so light that it will float if accidentally dropped in lake or river.



2. THREE-SIDED BODIES in place, clamps are hydraulically tightened. The truck is backed up to load. Binder chains prevent spilling.



3. BOTH BODIES UP, Pack-Hauler is ready to roll for delivery of both sections at the same site or split loads at different places.



One-man car shunter

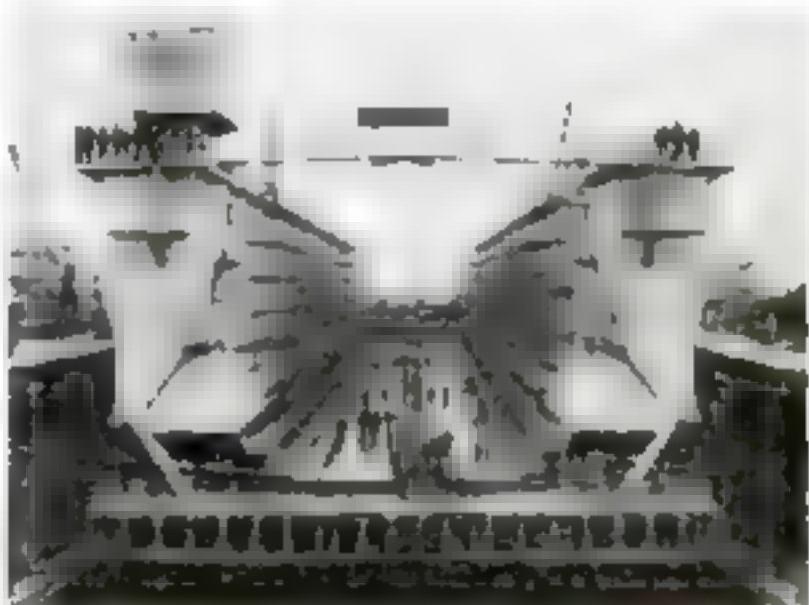
This six-hp. switch engine makes a one-man job of moving railroad cars weighing up to 100 tons. The device follows the rail automatically and balances itself with practically no help from the operator. It can cross tracks, ties, and switches.



Mobile control tower

Air-traffic control vans that can be flown to temporary landing strips are being built for the Air Force.

The two-wheeled vehicles, five feet square by five feet high, have room for an operator and much of the basic equipment of large airport control towers: two-way radio, altimeter, chronometer, and an anemometer to gauge wind speed and direction. Once at an airstrip, the unit can be put into operation in less than an hour. Hamilton Standard is making them.



Nuclear dry dock

For building Britain's first atomic submarine, HMS Dreadnaught, this floating dock was constructed at a cost of \$3,000,000. It is 400 feet long, 77 wide, 65 high—large enough for frigates and destroyers, too.

What we know—and don't know —about hay fever and other forms of one of man's most common and baffling ailments

By Lawrence Galton

THIS is the month—the sneezing season for eight million hay-fever victims—when allergy hits the headlines. But, more and more, it's making news the year round.

If you could concentrate all *known* allergy sufferers in one place, you'd have a

What does "allergy" mean?



Not even medical researchers have a completely satisfactory definition. Literally, it means altered reaction. You don't understand that? The experts aren't sure they do, either—not fully. About all that can be said with certainty is that allergy is a peculiar sensitivity that some people develop to substances that are ordinarily harmless to most other people.

Who can become allergic?

Anybody. At any time. The infant in the crib is subject to eczema; the growing child, to asthma; the adult worker can lose his job, or find it torture, because of allergy to substances he has to work with. At least 20 percent of all occupational disorders now are allergic and the work loss runs to around 25 million man-days a year.

Is allergy increasing?

Yes. One reason. We're being exposed at a fabulous clip to new man-made substances that can produce sensitivity. Every 24 minutes now, some new chemical compound is introduced by industry. Another reason: the constant spreading out of allergic sensitivities by inheritance.

Must you inherit allergy?



You don't have to. There are both hereditary and acquired types.

Actually, it's not a specific allergy that is inherited—but rather a tendency to become allergic. The more allergic the family, the more likely the allergic inheritance—and the earlier the trouble. With one allergic parent, one-third of the children have allergy before age 10; with two allergic parents, two-thirds of the children have it, usually before age six.

Even so, there's no telling what form it will take. An asthmatic father may have a child with hay fever or eczema who will never get asthma. Or an egg-sensitive mother may have a child who thrives on egg but can't tolerate wheat.

But even without a hereditary background, you can pick

Hidden Allergy?

city almost 10 times the size of Detroit. At least one of every 10 Americans—17 million in all—is allergic to something or other, in one way or other. And, some authorities say, you'd have to double that figure if you lumped in all the people who may have allergy without knowing it—

fatigue and heart and brain types of allergy, and other curious, even bizarre forms.

Allergy ranks as one of the most common and most puzzling of all disorders. Here's a rundown on what science knows—and doesn't know—about it

up an allergy strictly on your own. Sensitivity to poison ivy is one example. Among many others: allergic reactions to solvents, sawdust, dyes, drugs, insect bites.

To complicate matters, you can have hereditary and acquired allergies at the same time.

How does an allergic reaction develop?

Allergy, somebody once remarked, began as a by-product of nature's mechanism for keeping the individual alive—and has gone on to make him sometimes wish he were dead. If you're allergic, it's as if you're prepared to defend yourself against enemies that never were.

Normally, when disease germs enter your body, your blood turns out special chemicals, called antibodies, to fight the bugs. But in many people the blood is fooled, the mechanism goes wrong, and antibodies are poured out for dust, pollen, eggs, or other substances not necessarily harmful.

Once this happens, you're "sensitized." Next time you're exposed to one of these substances, there's war. The antibodies are in the blood, waiting. They collide with the dust or egg. A chemical, histamine, is thrown off in the reaction.

This chemical, like a cloud of radioactive dust after an atomic explosion, can settle all over the body. Any place it lands that happens to be especially sensitive to it—the skin, breathing passages, stomach, even the heart—reacts.

How allergic can you get?

One eight-year-old Oklahoma boy is violently allergic to almost everything—from chocolate, fruits, fresh milk, and every kind of pet except goldfish, to pillows, starch, flannel, rugs, and many drugs.

You can be so sensitive that you don't even have to go near the cause of your trouble.

A machinist, who developed an allergy to naphtha used in the shop for cleaning machine parts, got a disabling skin outbreak over his whole body. Off the job for several weeks, his skin cleared. Advised by his doctor not to return to the same kind of work, he went back only to tell his employer he was quitting. He didn't go into the shop itself, only to the office. Next day, his hands and face were swollen.



Can allergy be a killer?

Yes, but fortunately deaths from overwhelming allergic reactions—anaphylactic shock—are rare. Such reactions—to a shot of penicillin, for instance—are often foreshadowed by less-severe previous reactions to the same thing. They can be avoided. And when they do occur, it's often possible for emergency treatment—a shot of adrenalin—to save life.

What substances cause allergy?

An almost endless variety. You can inhale them, swallow them, or get them onto or under your skin.



Some years ago, finance officers at an Army post in Texas came down with allergy to money—ink on a new currency. In Toronto, one young man was in danger of losing his beloved because she got hives every time she saw him. Fortunately, it turned out that she wasn't allergic to him—only to his gifts of candy. He changed his tactics and won her with flowers.

Among the most common allergens (the word for allergy-producers) are milk, wheat, and eggs; pollens and house dust; fabrics, dyes, and solvents. Once only proteins, the essence of living matter, were believed to be allergens. Now it's known that almost anything can produce allergy, maybe by hitching a ride on body proteins.

Many drugs—antibiotics, hormones, insulin, and others—can trigger allergic disorders in susceptible people.

You can also develop allergy to light, heat, and cold.

Can you be allergic to people?

A woman in Des Moines won a divorce when she testified that her husband's presence gave her hives. A New York woman often went to Arizona where she got relief from her asthma—except, she discovered, when her husband went along with her. She now lives in New York, free of both asthma and husband.

You hear such stories. However, the fact seems to be that there's no allergy to another person—but to something connected with that person. This can range from the hair lotion he uses to the lipstick she wears.

How common is insect allergy?



More common, according to recent research, than anybody ever thought.

Allergic reactions to bee and wasp stings are well known. Mosquito bites, too, can produce severe reactions in sensitive people. Asthma from bedbug bites has been reported. Fleas and lice produce their share of allergic reactions.

And only recently has come the discovery that insects can be a major cause of hay fever. Just as grass, ragweed, and other pollens get into the air, so do tiny, disintegrated bits of dust given off by millions of insects. Some of the trouble sources: May flies, silk pupae, house flies, grasshoppers, melon flies, mosquitoes, honey bees, and water fleas.

Can you be allergic to drinking or smoking?



Tobacco is the allergen most often associated with heart allergy, some researchers believe. In one study of 100 men with heart disease, all heavy smokers, 44 were found to be sensitive to tobacco. There have been medical reports that some patients whose hearts "jumped" or beat irregularly or who had pains around the heart have been relieved by abstaining from smoking.

Alcohol has been found responsible for heart symptoms—and for others as well. One physician has reported the case of a man with a serious eye disease—acute glaucoma—who was a heavy wine drinker. When tests showed allergy to grape and he stopped the wine drinking, it cleared up

How else can allergy affect you?



A doctor became so overpoweringly sleepy every afternoon at about three o'clock that he was unable to go on seeing patients. His colleagues, who put him through many tests, could find nothing organically wrong. An allergist solved the problem by banning milk. This is one of many cases of allergic fatigue reported in medical literature.

There have been many reports, too, of "cerebral allergy," which is believed to act like giant hives in the brain. It produces swellings and pressure that can cause a wide variety of mental symptoms. One group of allergists reported studying 5,000 patients with depression, sluggish thinking, and many other symptoms, including stuttering—all traced to allergy and relieved by anti-allergic treatment.

Another group of nine allergists put on an exhibit at an American Psychiatric Association meeting showing that symptoms of mental disturbance, ranging from moodiness and irritability to maniacal behavior, can come from foods. Corn, wheat, coffee, milk, eggs, and potatoes—in that order—are the worst offenders. The allergists reported producing neurotic symptoms at will simply by feeding patients foods to which they were susceptible. In minutes or hours, depending on the quantity given, the patients became dopey, drowsy, and unable to make a decision or to read with understanding.

Do emotions cause allergy?

Some psychiatrists have claimed that allergic disorders are all in the mind. Some allergists say emotions don't enter into allergies at all. Many doctors now take the middle ground. They believe that allergy is a physical disorder but that it sometimes can be greatly aggravated by emotional problems.

Is allergy outgrown?

Sometimes allergies disappear spontaneously. But most do not. One popular belief—that the asthmatic child will outgrow his condition—is particularly dangerous. Untreated

[Continued on page 188]



FAR CRY FROM THE IGLOO is this prefabricated, pre-insulated Arctic house. It was constructed in seven hours with plywood-sandwiched styrofoam panels locked together for floor, walls, and roof.

How it's built ➤

Arctic hut locks together

Using prefabricated locking panels, four men can put up this house in a day—and take it down again in half that time. The panels are plywood-covered styrofoam designed for insulation against Arctic cold. They have edge-mounted recessed locks that turn with a key. There's no basement—the floor is locked to joists laid on the permafrost ground. Wall panels are locked to the floor and to each other. The roof is locked onto the wall panels.

Locks are made by Simmons Fastener Corp. of Albany, N.Y. Arctic Units Ltd., Toronto, designed the panels, is putting up 90 Eskimo houses and other buildings on the DEW Line and for the Canadian Department of Northern Affairs.



CUTAWAY VIEW of recessed Dual-Lock. When key is turned, trigger action engages pin, prevents unlocking by vibration.



Electric gun jolts sharks

A long spear with a pistol grip is the latest for scaring away sharks. The diver demonstrating it at left in a Hollywood, Calif., tank pulls the trigger and delivers an electric shock. A battery worn on his back provides the charge.



1. FLOOR PANELS are locked together on joists. Time required for installing floor was one hour. The foundation took 1½ hours more.



2. FIRST WALL PANEL to go up is the door. It's put in position and locked to the floor. Double-acting locks bear 2,500-pound tension.



3. OUTSIDE AND PARTITION WALLS are locked both to the floor and to each other. Four men erected them in a total of 1½ hours.



4. ROOF PANELS, insulated like walls and floor, are also fitted with locking devices. Putting them on the house took three hours.

Custom for a queen

Exceptional visibility is the main feature of this Rolls-Royce Phantom V, which has been factory-modified for Queen Elizabeth. A seven-passenger limousine similar to the standard model that sells for \$18,600, the maroon-and-black car features oversize rear-quarter windows, plastic wrapover rear windshield, glass roof insert.

The roof window can be covered from inside with an electrically operated sliding panel, while a folding metal panel encloses the rear windshield when the car isn't being used for ceremonial purposes. When removed, the panel fits in the trunk.





What's in a Nameplate?

House signs like these, many homemade, are a current fad in California. It's not a game everybody can play (what would you do with Jones or Wilson?) but, with a little imagination, maybe your own name will lend itself to this happy pictorial punning.





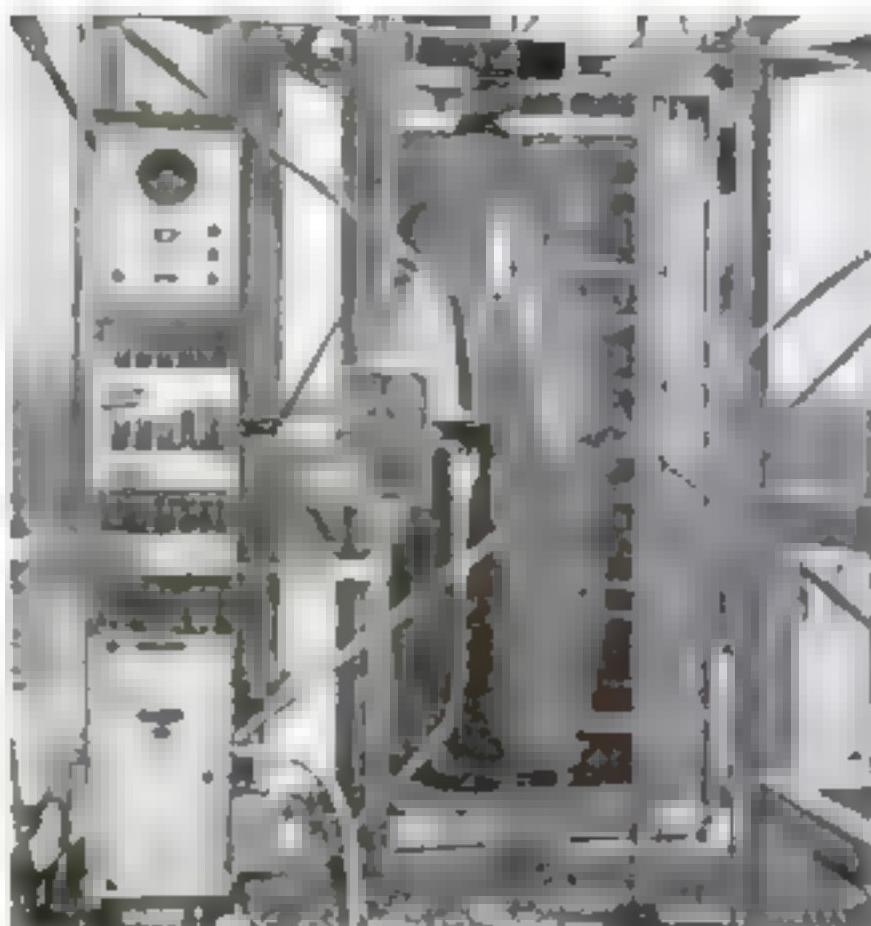
Radio-Controlled Elevator Climbs

ONE of the scariest rides in the country is reserved for visitors to the transmitter of the Portland, Me., television station WGAN-TV. Its antenna tower is the tallest structure yet made by man, stretching nearly a third of a mile straight up. There's an elevator, a flimsy open-fronted cage barely big enough for two. The ride up—to a platform just below the top—takes about 10 minutes, if the cables don't slip.

The 1,619-foot tower is a wispy lace-work of steel steadied by guy wires. Despite its frail appearance, it can stand up under 152-mile-an-hour winds (but would sway $6\frac{1}{2}$ feet).

The elevator covers such a long lift that a direct wire connection between the control buttons inside the cage and the hoist motor at the tower bottom was impractical—too much slack to handle. So the whole thing is radio-controlled. Passengers can even talk to the ground by radio (if that's any comfort). Station engineers wisecrack that the elevator requires more vacuum tubes than the television transmitter.

The elevator was not installed to titillate visiting firemen (though the view from the top is stupendous), but to simplify maintenance—antenna repairs,

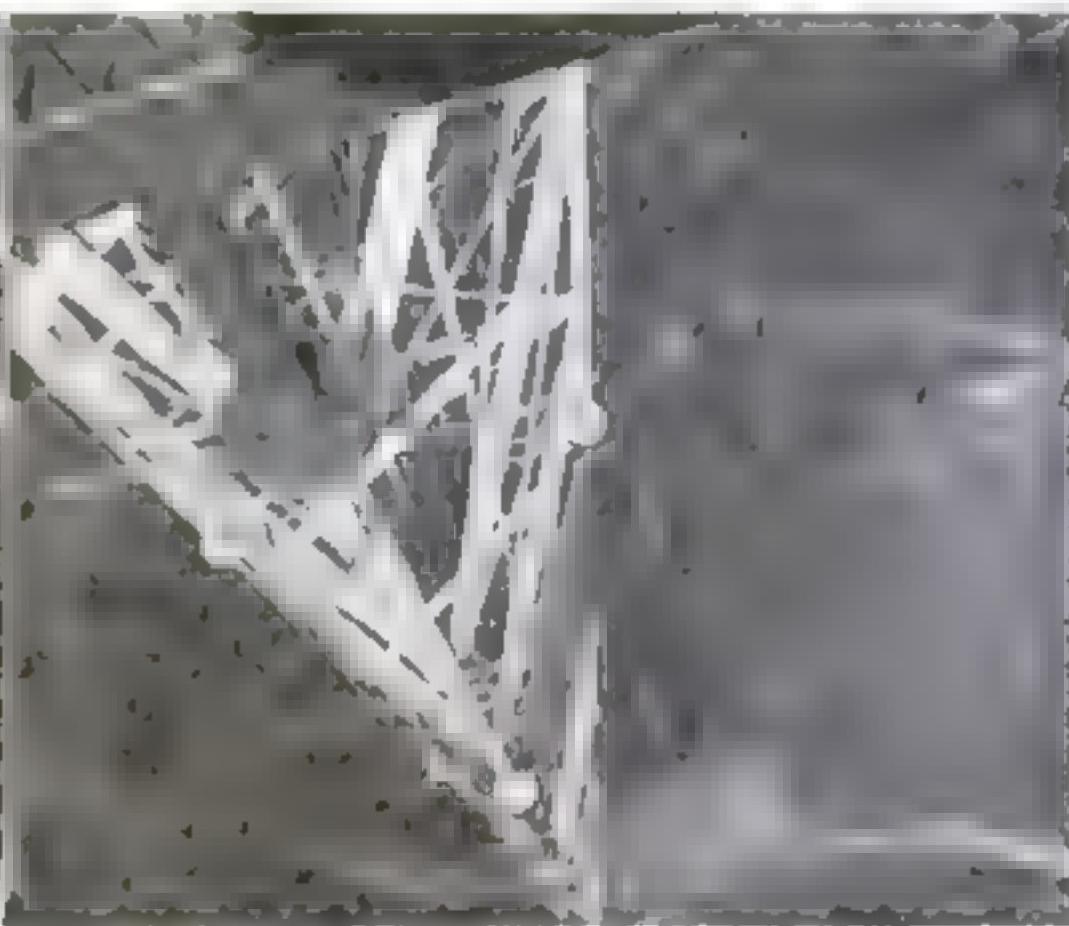


RACK FULL OF ELECTRONICS radio-controls the tower elevator. Crude emergency stop—pull handle—freezes cage to guide rails with cams.

painting, replacement of airplane-warning lights. The high-in-the-sky tower, which cost Guy Gannett Broadcasting \$250,000, pays off with good TV reception for 90 miles. Its distinction as the world's tallest won't last long—another, a few feet taller, is rising in Missouri.



THERE IS A LADDER, but it takes three hours to climb to the top. This space, enclosed by triangular tower, serves as the elevator shaft.



LOOKING DOWN FROM 1,600 FEET (ulp), here's what you see. Tower was built of 30-foot prefab sections, bolted together one on top of another.

World's Tallest Tower

HOW TALL IS 1,619 FEET?

WEAR-TV
TOWER
1,619 feet

EMPIRE
STATE
BLDG.
1,472 feet

WASHINGTON
MONUMENT
555 feet

TOPPING TALLEST BUILDING, tower soars so high you get dizzy looking up at it from bottom.



1. Nitroglycerin is placed in tower, set off.



2. Upright falls toward the approach span.



3. Crash onto approach takes it down, too.



4. All that's left now is the clean-up job.

Dismantling a drawbridge the easy way

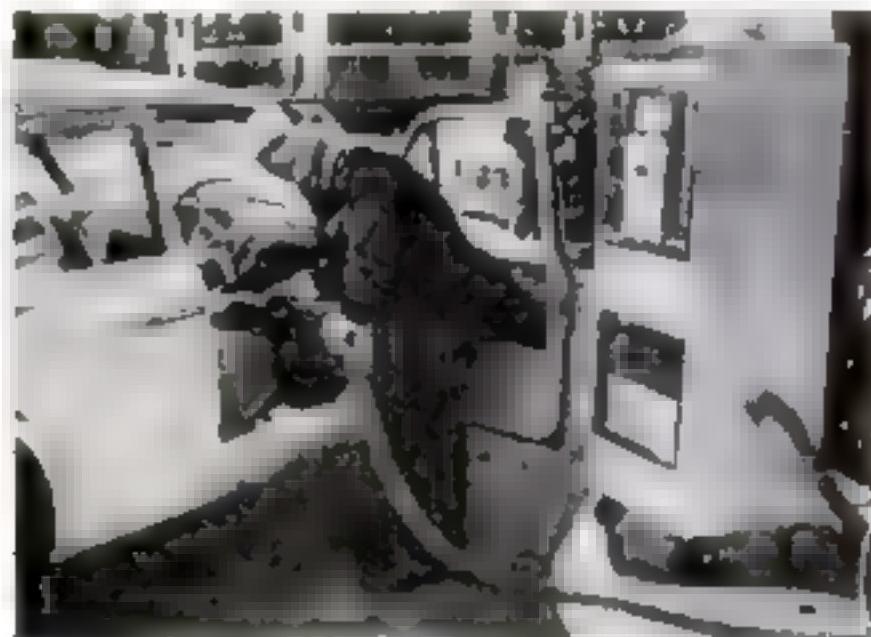
Wreckers used nitroglycerin to help dismantle a condemned drawbridge over the Chesapeake and Delaware Canal at Summit Bridge, Del. They lowered the main span to a barge and towed it away

for salvage. Then they took care of the 183-foot towers with eight charges, placed strategically so each tower would fall on its approach span at the bank, where it could be reached with cutting torches.



Big ears to hear better

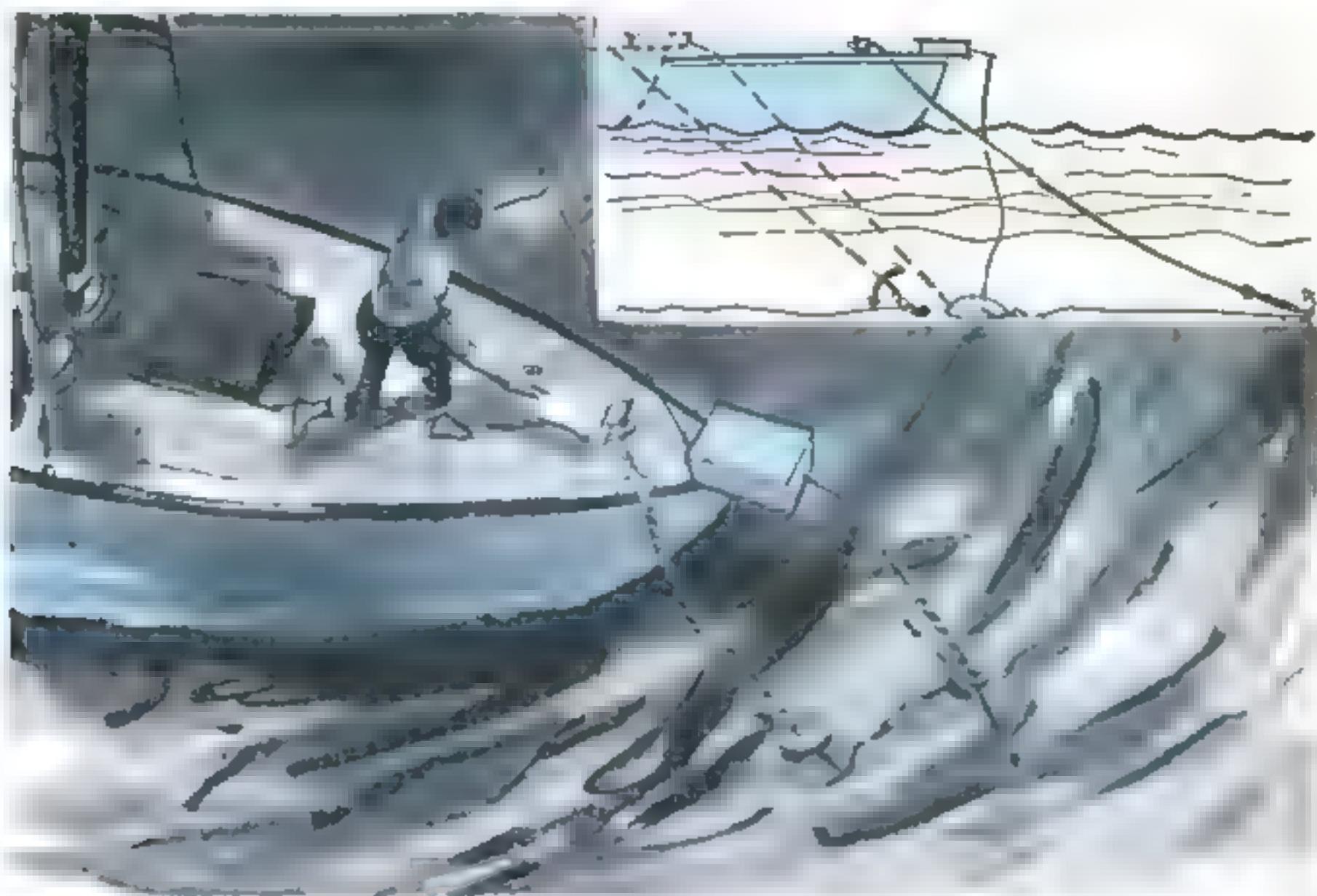
No, the man above is not a member of a Mickey Mouse fan club. He is wearing the strange headgear to demonstrate a French invention that amplifies fog signals at sea so they can be heard clearly.



Car-cleaning vacuum

A coin-operated car vacuum cleaner may soon be standard equipment in London's service stations. Designer Jeffrey Sass demonstrates above his Vacmobile. It costs seven cents for three minutes.

New Ideas from the Inventors

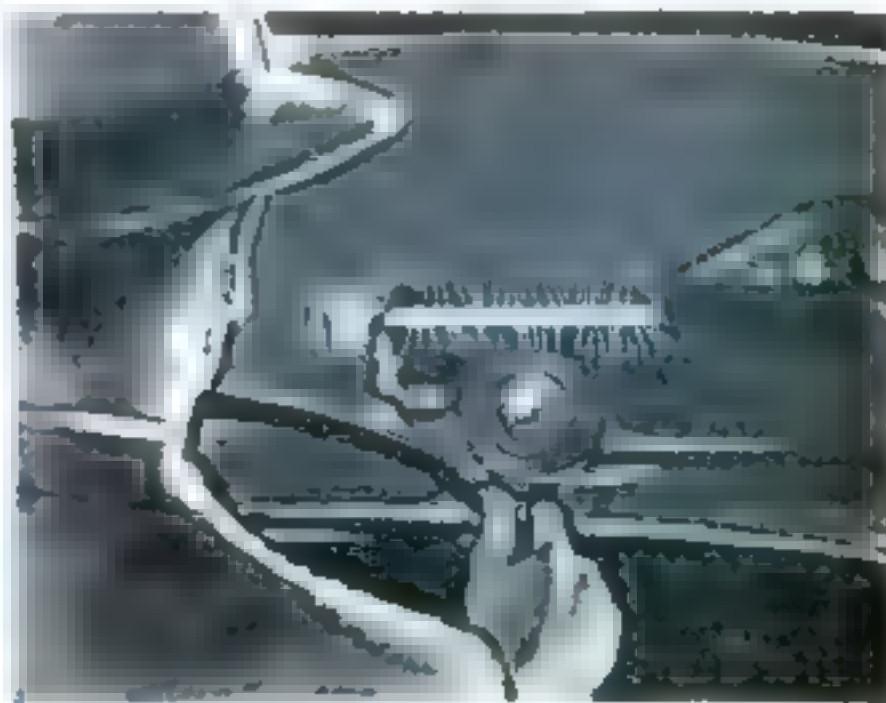
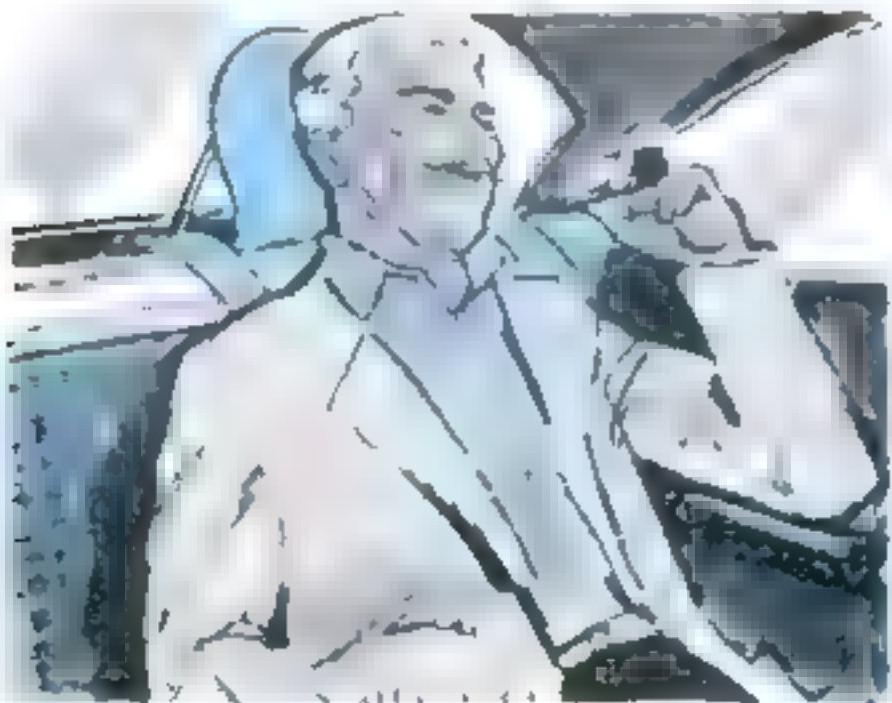


Alarm Signals Anchor Drift. You wouldn't have to keep a night watch on a small boat that had this recently patented alarm to call you if wind or tide

loosened an anchor's grip. Drift would cause a weighted line to tug a shaft and close a bell or light circuit. Normal circling, however, wouldn't set off the alarm.

Back Support Rests Rider's Head. Slipped over the back of a car seat (or a train seat or an easy chair at home) this portable, fold-up headrest would provide comfortable head and neck support. And in moving vehicles, it would allow passengers to doze in greater safety.

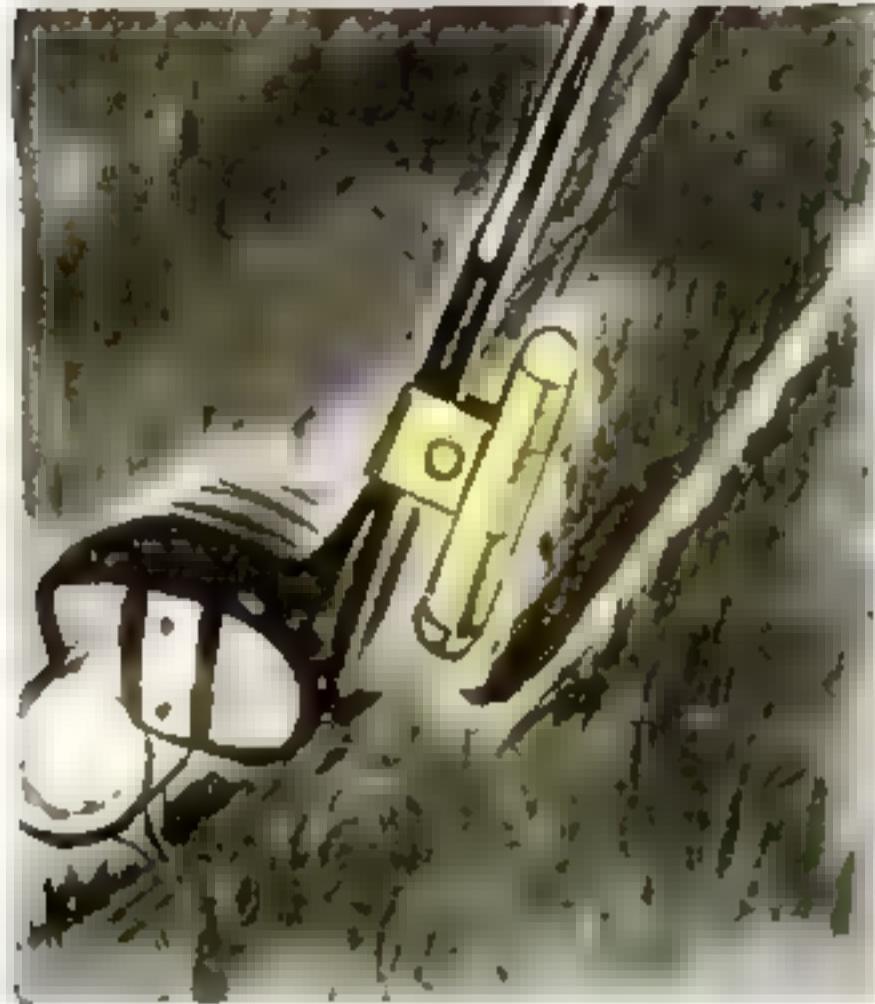
Stripe Bend Headlight Glow. Today's shrouded headlights make it harder to see crossing cars from a safe distance. But these tubular-plastic trim strips might make cars more clearly visible from the side. They'd "pipe" light from headlight recess to fender trim line.



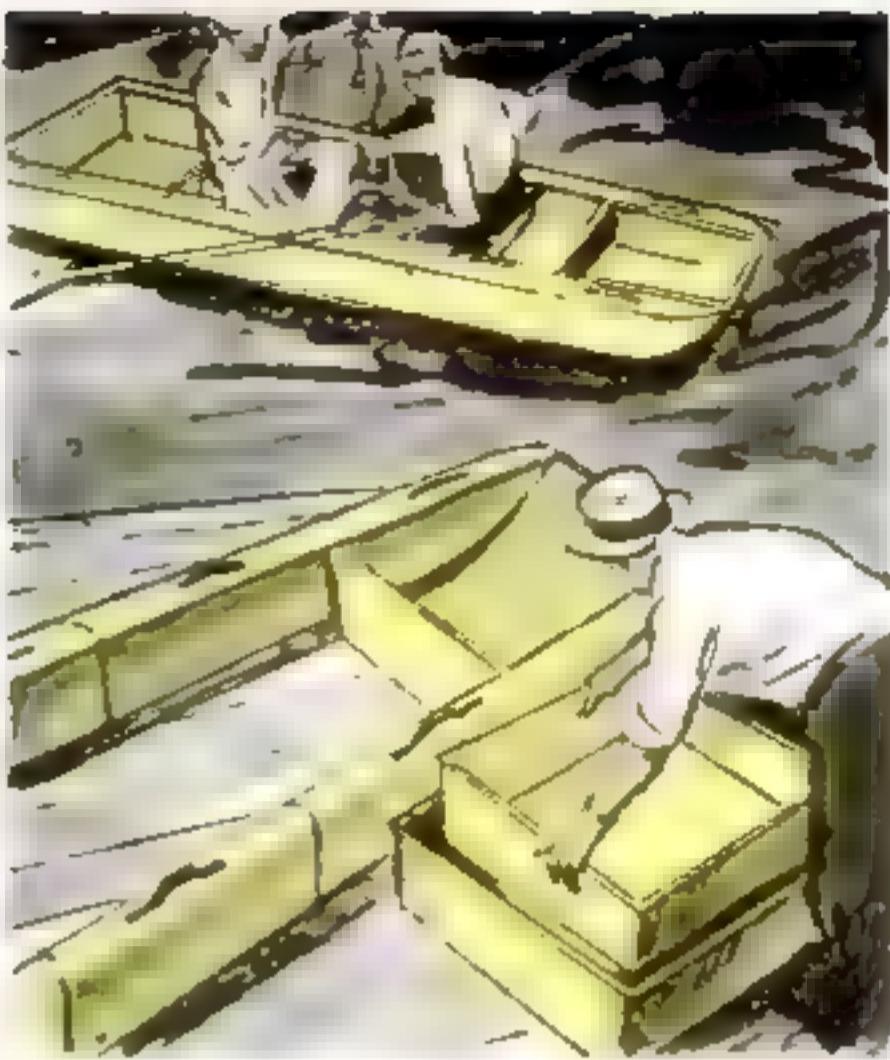
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More Inventors' Ideas



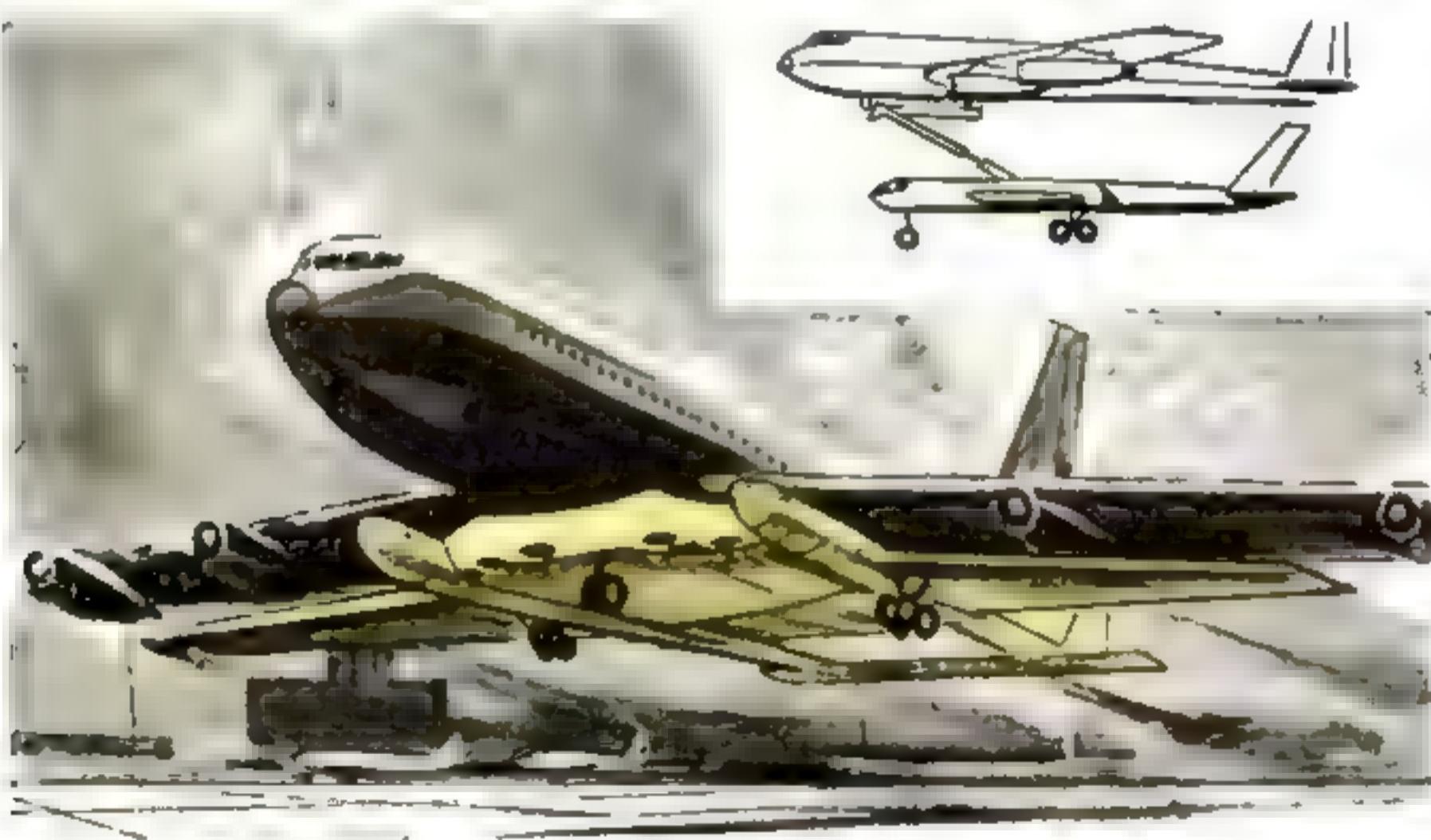
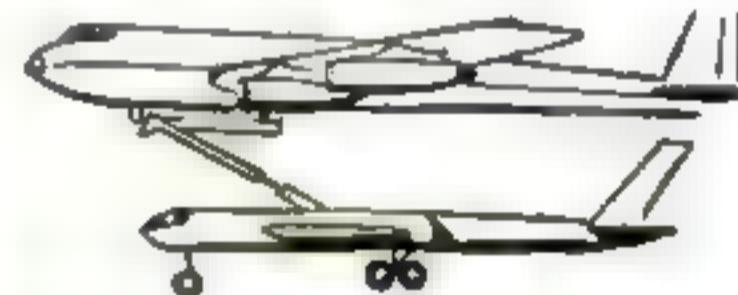
Dye Traces Golf Stroke. Want to know what's wrong with your swing? You could draw yourself a picture by filling this indicator with colored powder and clamping it to your club. Ejected from the nozzle by centrifugal force, a powder spray would trace the path of your swings.



Boat Sections Nest for Storage. With its box-like sections nested one in another, this fold-up boat could be easily carried in a car trunk. To assemble the light, compact craft, you'd bolt the individual watertight sections between folding, foam-plastic sponsons.

Flying Wheels Stretch Jet's Range. A plane could carry a bigger payload farther if it didn't have to tote bulky landing gear all the way. The separate, piloted

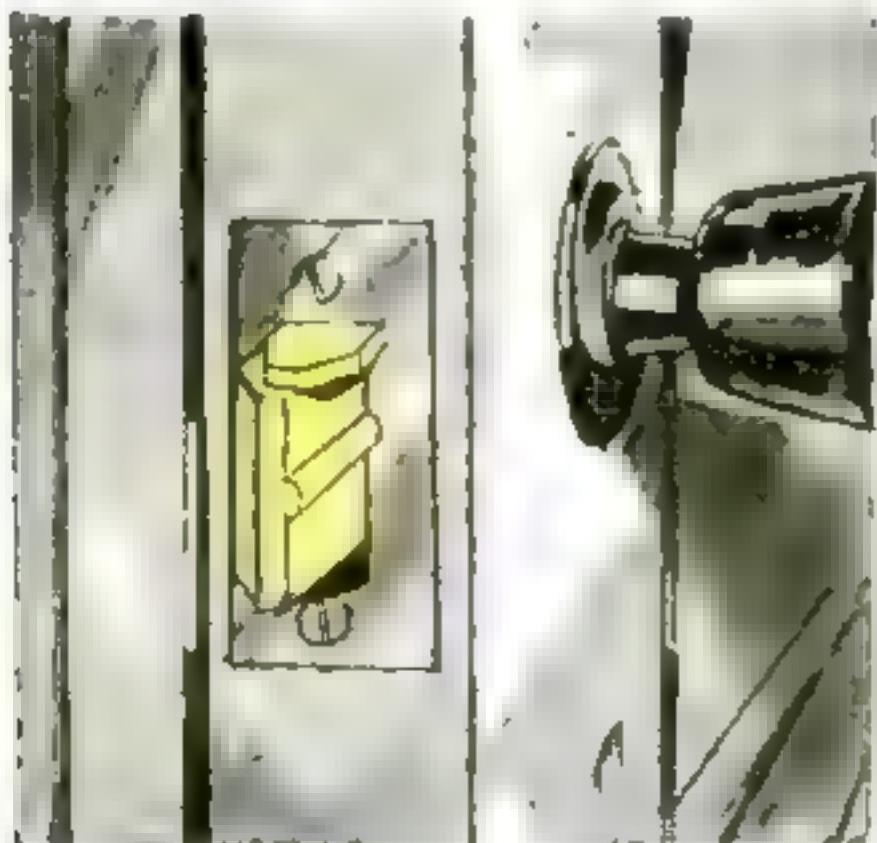
landing section of this composite plane would disengage after takeoff, then fly out to meet and join arriving, long-range aircraft before they touched down.





Compass Flash Points the Way. With a compass recessed in the plastic cap of a flashlight, you'd not only see your path but would know which way it leads. The compass would be in a translucent shell so its dial would be automatically illuminated when you switched on the light.

Latch Still Door Rattles. This two-part latch might silence the sleep-disrupting clicks of even the loosest door. Pushed by a spring, its conventional bolt would engage the strike plate in the jamb in the usual way. A second, wider element above the bolt would slide forward far enough to fill any remaining slack and thus keep the door from rattling.



Copter Sprinkles the Lawn. Water pressure against the vanes of a turbine in this toy helicopter would spin the rotors to keep it in flight, then flow down through a spray nozzle. A semi-rigid hose—such as aluminum tubing—would help support the copter and keep it circling.

The following patents have been issued on these inventions:
Drift alarm—No. 2,810,120 to T. Parker, Durham, N.C.;
Headrest—No. 2,801,677 to D. Pinkerton, San Francisco, and J. McAlister, San Diego, Calif.; **Fender strip**—No. 2,808,502 to P. Large, Los Angeles; **Golf marker**—No. 2,804,306 to C. Chedester and A. Rucco, Livingston, N.J.; **Boat**—No. 2,919,451 to F. Long, Shreveport, La.; **Plane**—2,921,716 to D. Borden, Oak Ridge, Tenn., and E. Wolf, Layhoga Falls, Ohio; **Compass**—No. 2,810,821 to H. Cohn, University City, Mo.; **Latch**—No. 2,807,488 to E. Schlegel, Burlingame, Calif.; **Copter**—No. 2,921,743 to D. Westcott, Monrovia, Calif.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

Giant Electric Shovel Mines Arctic Oil

THE most unusual oil field in the world is shown here. The nine-foot-diameter mining wheel (right) is an "oil well." In sub-Arctic northeastern Alberta, Canada, directly above Montana, its buckets scoop up the hard, black, sugary oil-soaked tar sands of the famous Athabasca deposits.

Men have known of the Athabasca oil fields since 1788, but never have been able to separate the oil from the fine sand

that millions of years of wind have blown into it. Now four companies (Cities Service, Imperial, Richfield, Royalite) are trying the method shown here. Cities Service is doing the actual work. It took \$3½ million to start operations, which have just begun. The stakes are the biggest in the petroleum world: If the oil and sand can be pried apart cheaply, deposits bigger than all known reserves of North America will have been opened up.

Men and machines battle cold for world's richest oil field



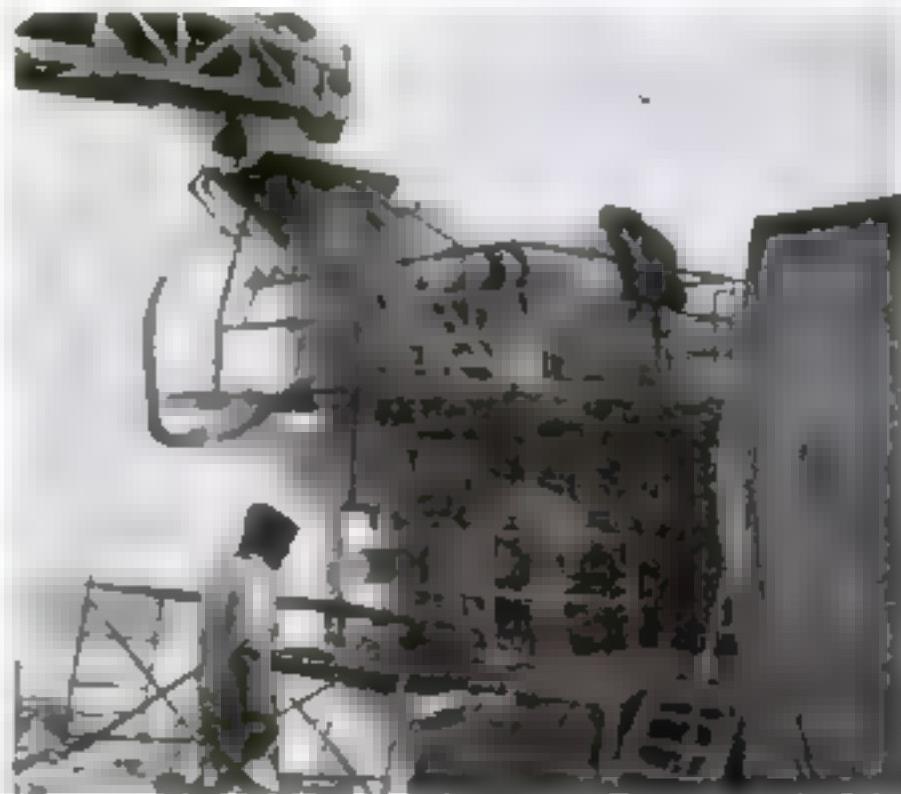
1 D-9 CATERPILLAR DIESEL shoves tar sands toward mining wheel, pushes aside the surrounding clay. Temperature at site often goes down to minus 44 degrees.



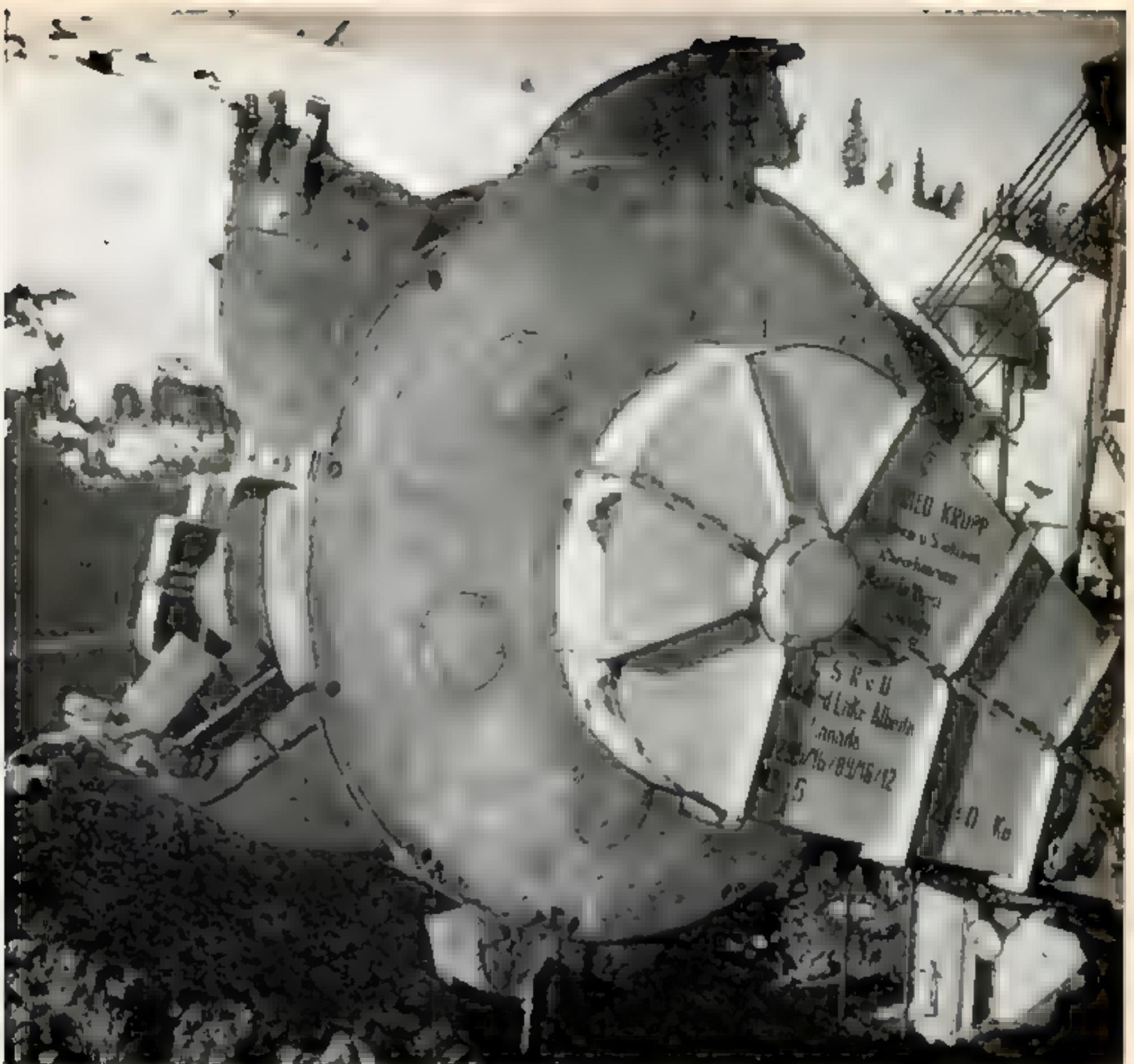
2 KRUPP-BUILT WHEEL bites into tar sands. Wheel is modification of one Germans use for mining coal.



3 OVER ITS SHOULDER, the mining wheel deposits sands on a 38-foot conveyor belt that runs along tail boom. Boom balances nine-ton weight of wheel and cab.



4 FROM CONVEYOR BELT, scooped-up tar sands are dumped into a mobile extraction unit to get sand out.



Diesel-electric mining wheel's six buckets are equipped with teeth to pierce frozen ground.



5 HEATED DILUENT, made from the tar sands themselves plus water, is mixed with sands. Water sinks, carries the sand down with it.



6 CRUDE OIL, floating on top, is sent through steam-heated pipes to refinery (background), where it becomes fuel oil, naphtha, gasoline.

RESEMBLING an enormous mattock, the submarine is 25 feet long and 8½ feet high. The craft's name, Goldfish, was suggested by the bright yellow paint. A specially designed trailer hauls the sub to and from the water.



HOME-BUILT SUB

NO WEEKEND golf or fishing for 26-year-old Burt Dickman—he prefers jockeying a 12,500-lb. homemade submarine around the lakes near his home town of Auburn, Ind.

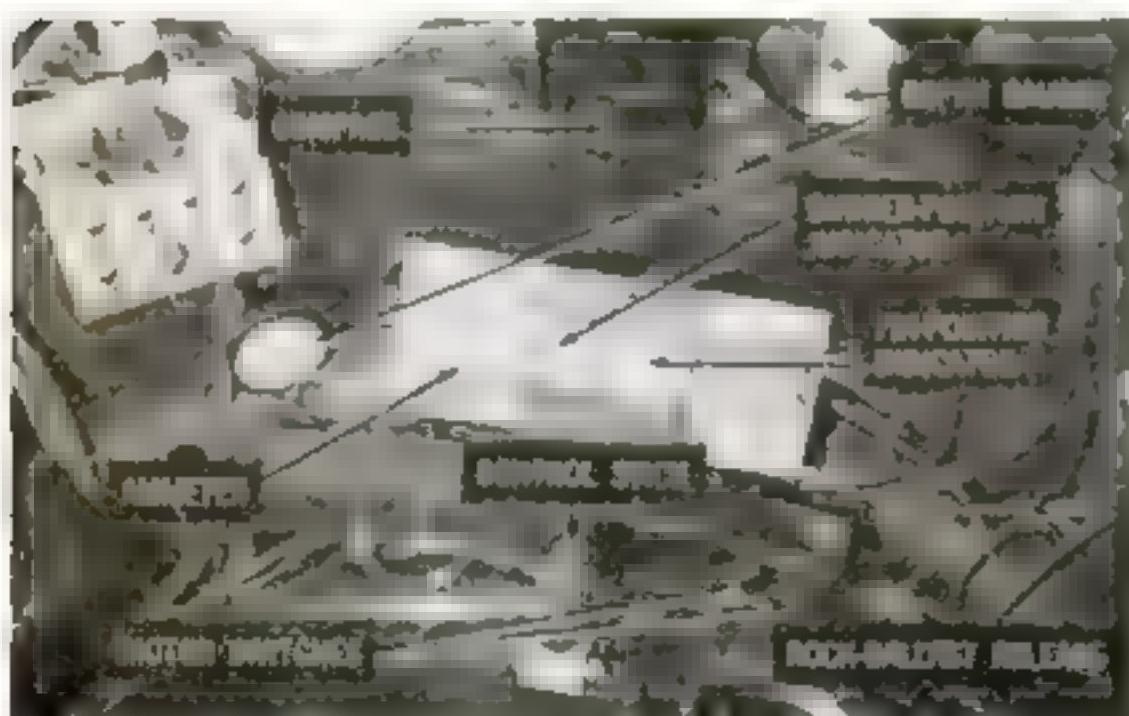
A former Navy submariner, Dickman took less than a year to build his unusual three-man craft. The basic hull is a 1,000-gallon gas-storage tank that has been reinforced with steel tubing to form the pressure cabin. Sheet-metal diving tanks, tacked on fore and aft, give the sub a double-wedge shape.

To submerge, Dickman opens valves that flood the 50-gallon center tank

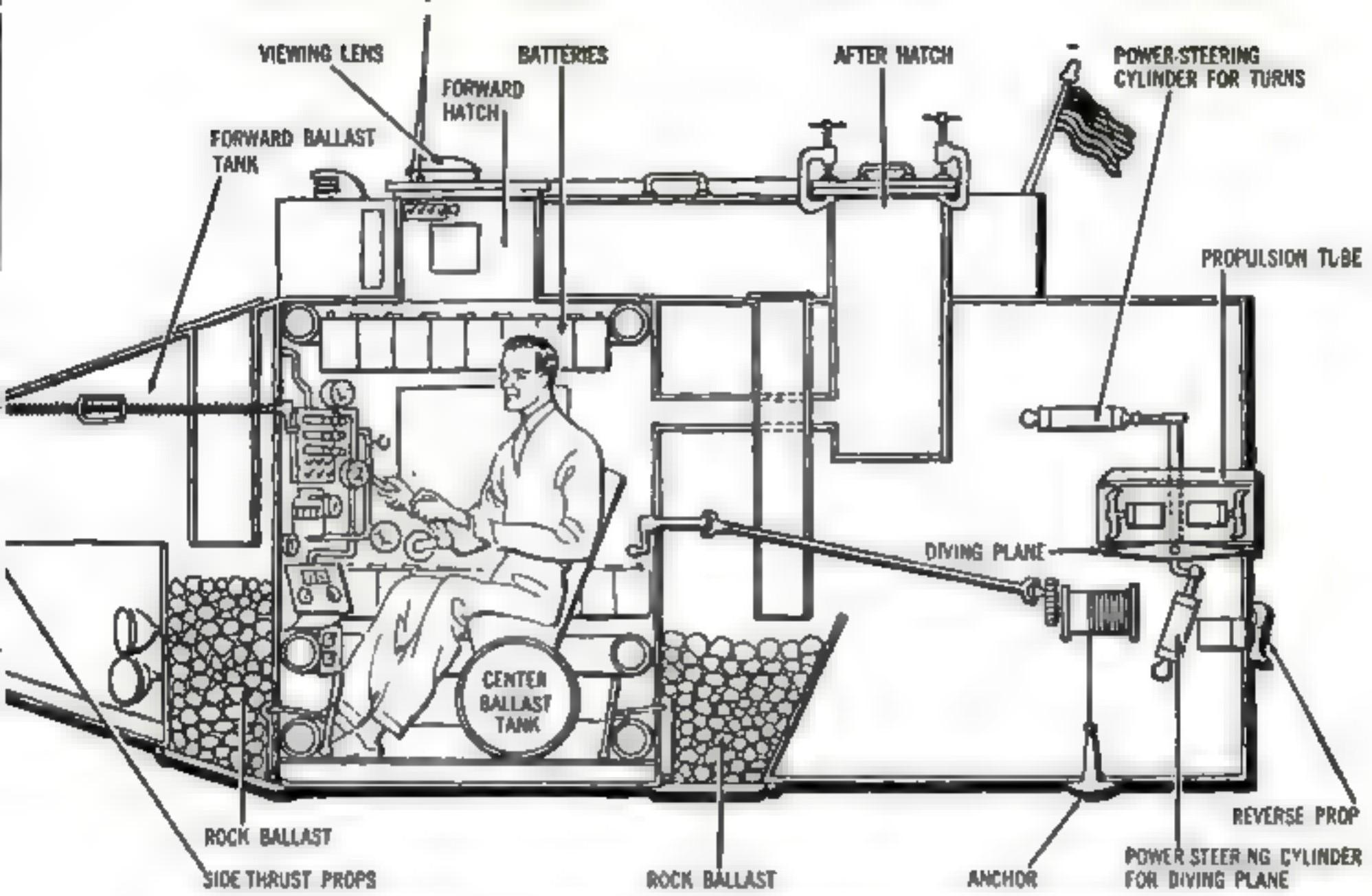
mounted beneath the passenger seats. For deeper cruising, he gets additional diving weight by flooding the fore and aft tanks. The sub is safe to below 200 feet, but Dickman prefers cruising at 30 to 60 feet. The pressure hull holds enough air to sustain three people comfortably for two hours.

Surfacing is accomplished by injecting compressed air into the center tank to replace the water. Stored in three large welding tanks mounted in the rear water-ballast tank, the compressed air is replenished by an electric compressor. As a safety measure, the craft carries two bins full of rock ballast; if Dickman should reach bottom with no compressed air and the ballast tanks full of water, he could still surface easily by dumping the rocks.

Steering and propulsion are combined in a single aircraft-type tail assembly. Two horizontal elevators



DEPTH READINGS are provided by two gauges. One records with great sensitivity to 34 feet; the other, less sensitive, reads to 200 feet.



also serve as mounts for the propeller tubes, which in turn double as steering rudders. Propellers are driven by Ford starter motors hooked up to 28 six-volt batteries.

Maneuvering. When such a massive craft is navigated at five m.p.h., the underwater forces are strong enough to necessitate power steering. A 10-inch universally jointed control lever operates the tail plane effortlessly. With the lever pushed to either side, the sub can make a complete turn in about two lengths while cruising. When it is at rest, two starter motors mounted in a transverse tube in the front tank can swing the ship around on its axis. A stern motor is for backing.

An alternate set of motor and rudder controls inside the coaming of the main hatch allows Dickman to operate the sub with the hatch cover just awash. In this position he can scan 360 degrees of the horizon through a huge hatch-mounted lens scavenged from the belly of a bomber. Dickman has tried two conventional periscopes, but likes the lens better.

With its large clear-plastic viewing area, the sub has proved ideal for underwater photography, observation, and just plain fun.—*David N. Keller*.



FIRST TO BREAK THE SURFACE is the viewing lens. With the superstructure awash, the sub can be navigated from atop the hatch ladder. Craft is fully surfaced in the bottom photo.

WHAT'S NEW.....



Sliding Top Covers Pickup

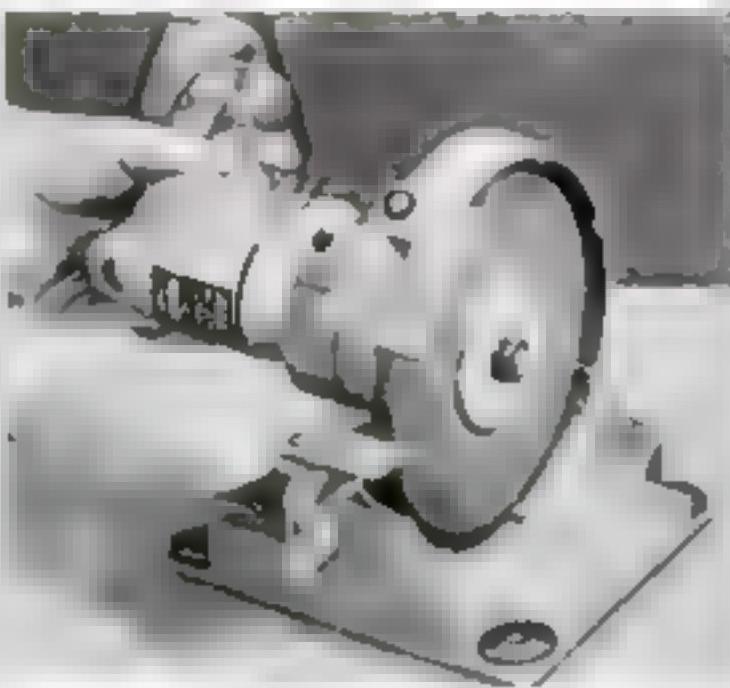
An aluminum canopy slides on a pick-up-truck body to protect the load from rain. It operates on roller bearings running in a full-length track, needs no fastening to hold it in place, and can be slid off in seconds for loading or unloading. \$160 to \$280, depending on size. Tennessee Aircraft, Inc., Nashville, Tenn.



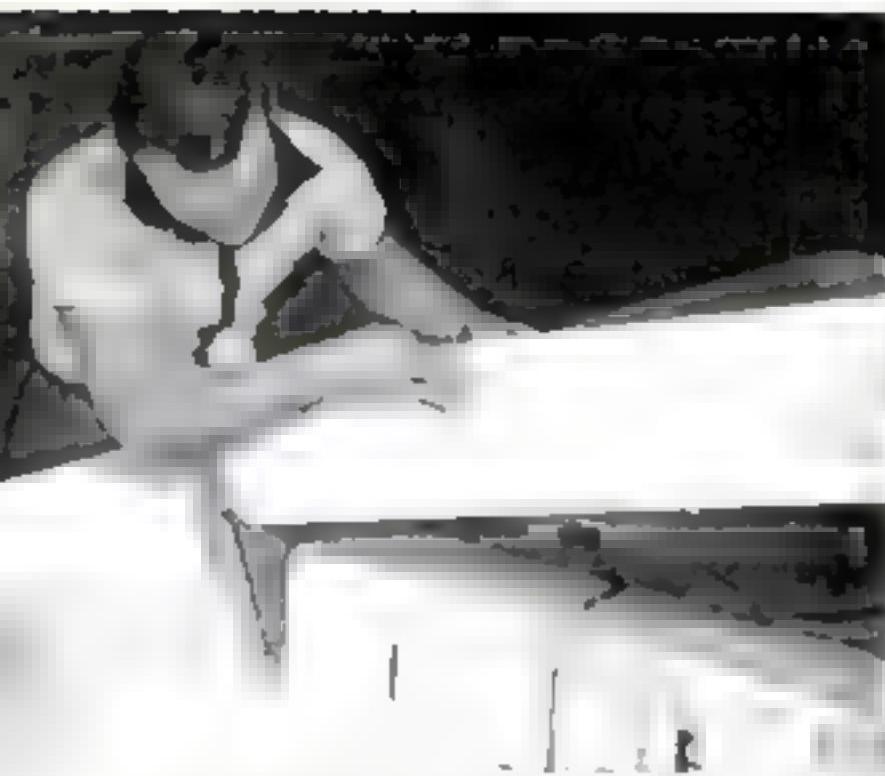
AUTO ALARM blows the car horn to keep you awake while driving. Press a button beside it when you feel drowsy, and put your left foot on the pedal. If you relax pressure, the horn starts blowing. \$11.95 Alertmaster Corp., 3212 Aberdeen, Houston, Tex.



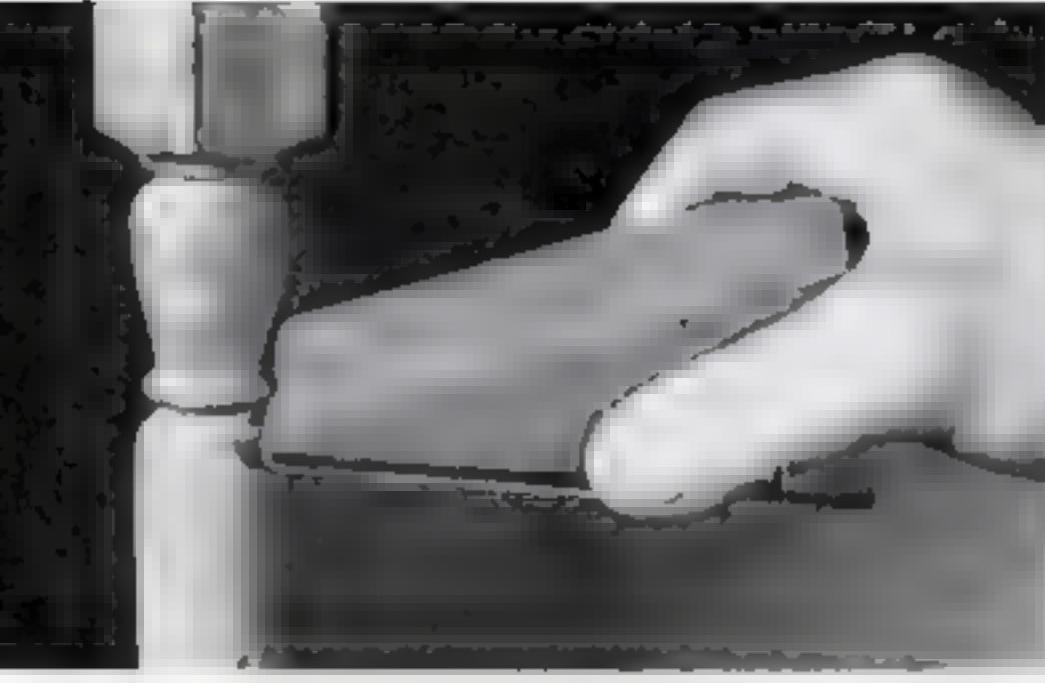
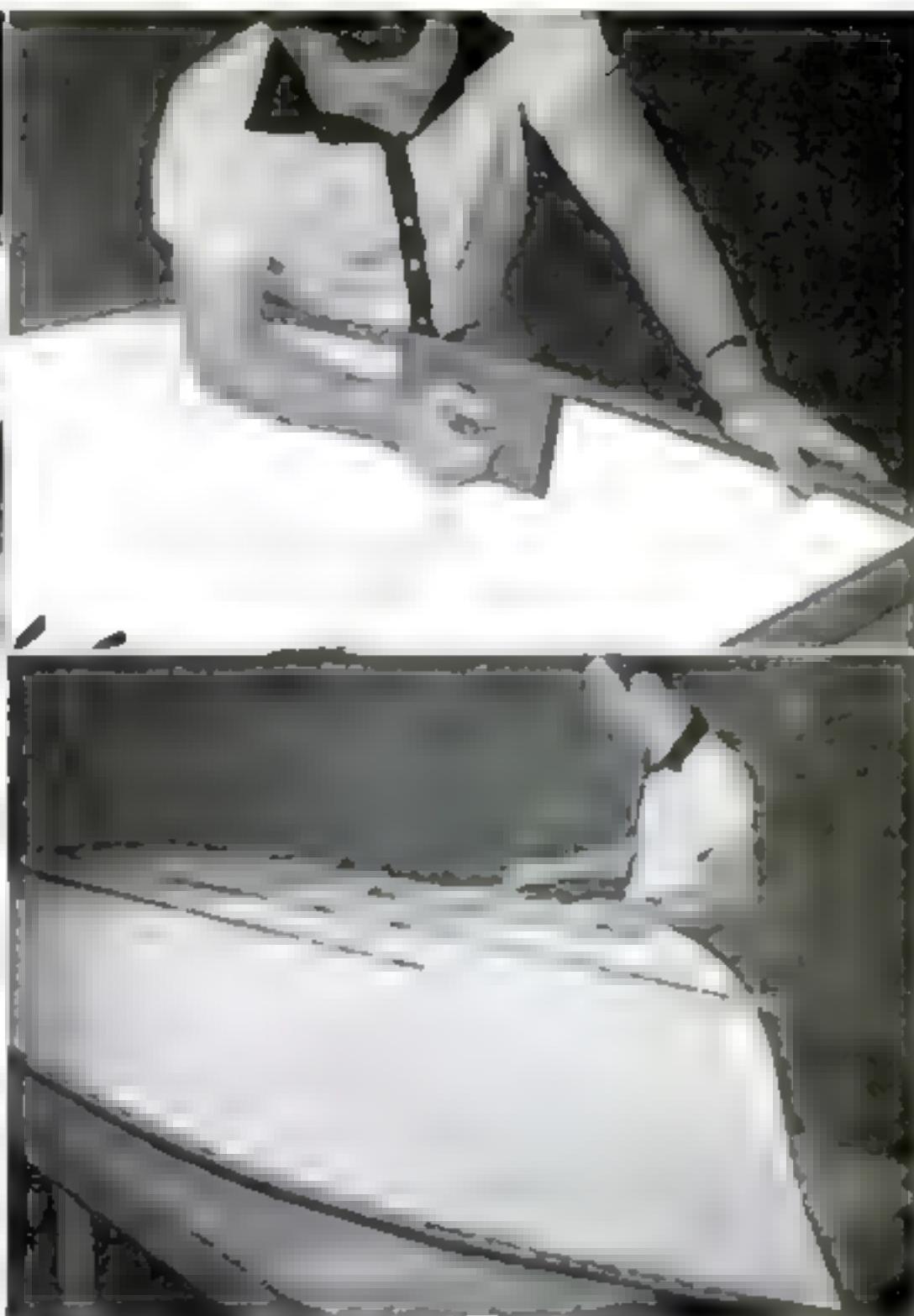
LAWN SPRINKLER has perforated adjustable arms that you lower or raise to spray a radius of 10 to 50 feet. Positions are calibrated on the arms to make it simple to set them for a desired area. Cost, \$8.45. Princeton Hardware & Plating Co., Princeton, Ind.



BENCH GRINDER is the latest in a line of Snap-Lock tools powered by a $\frac{1}{4}$ -inch drill. It fits standard 6-by- $\frac{1}{2}$ -inch grinding, wire-brush, and buffing wheels. The attachment is \$16.95 with one grinding wheel. Skil Corp., 5033 Elston Ave., Chicago.



ALUMINUM BOAT now comes in a kit for building yourself. It includes a one-piece welded hull with square ends or a pointed bow, seats that fit over nonsinkable polystyrene blocks, metal braces and brackets, oak gunwales, motor mounts, and keel strips. The only tools you need are a drill, screwdriver, and pliers. The boats, in seven sizes and styles from 7 to 14 feet, are priced from \$77 to \$119. Alumakit Co., Shetland Industrial Park, Salem, Mass.

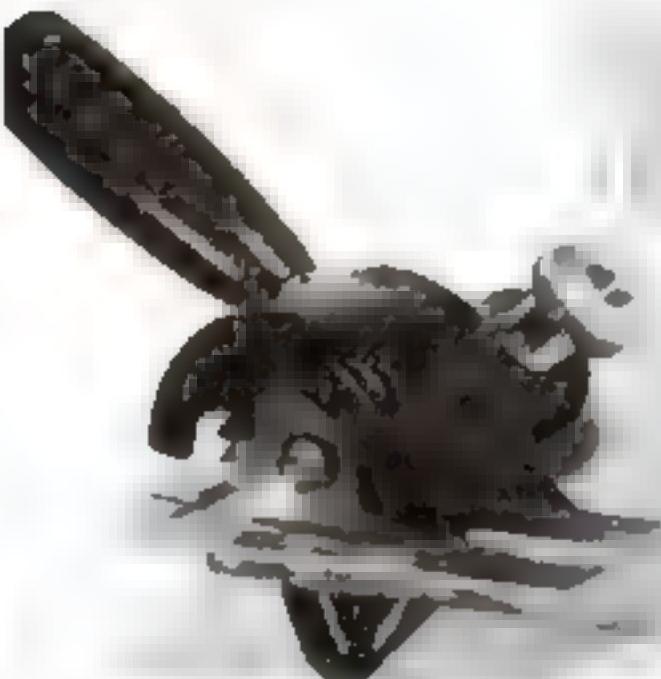
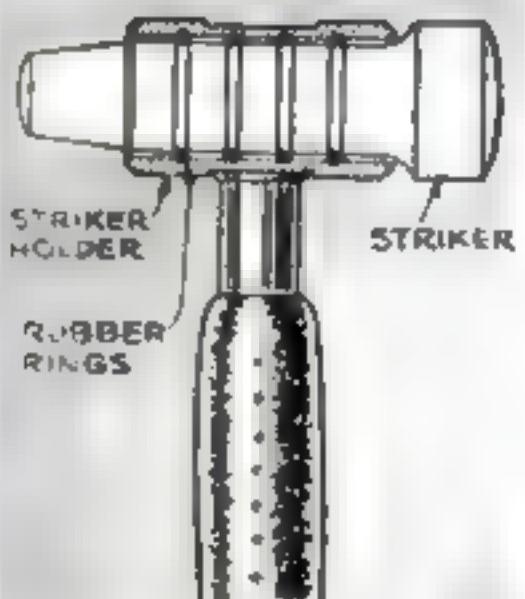
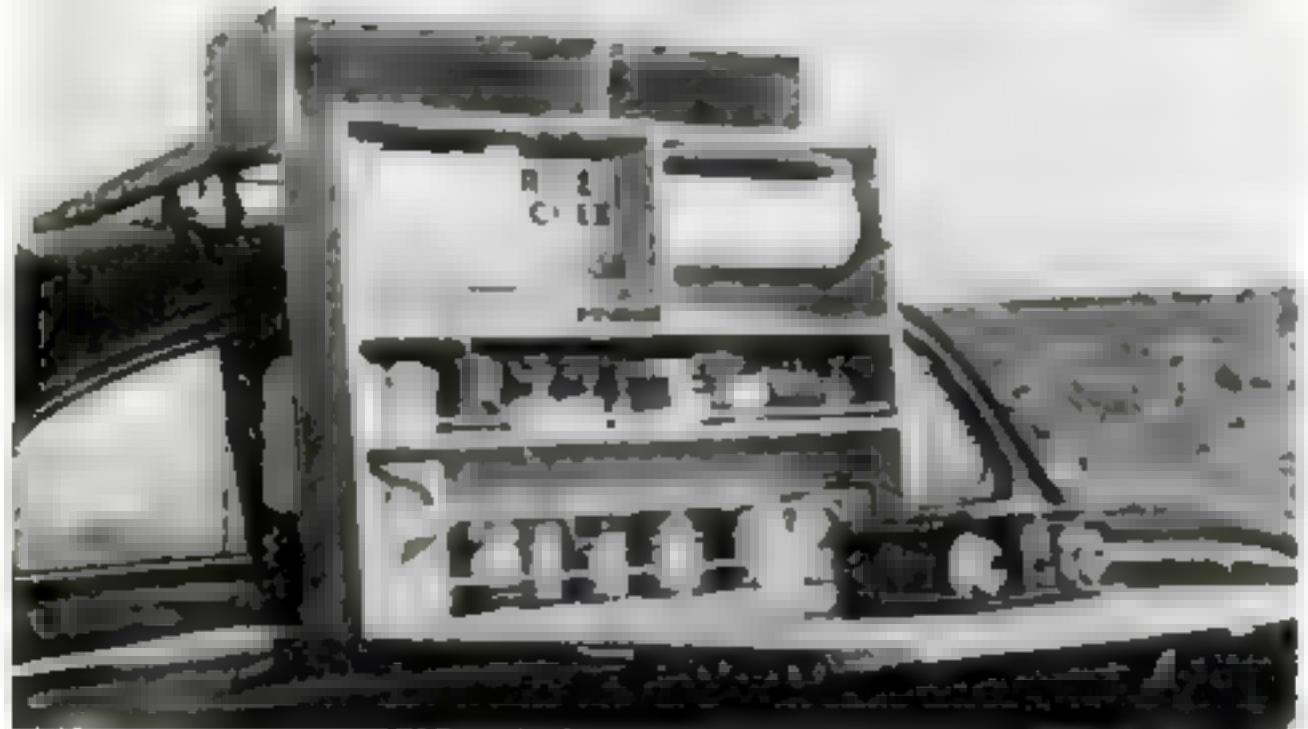


WEDGE-SHAPED SANDER gets into the corners and hard-to-reach crevices. The plastic block is covered with a layer of resilient rubber to cushion a strip of sandpaper, has a removable end panel that holds the paper in place and slides out for refilling. You can cut a 9-by-11-inch sheet into four refills that can be stored inside the block. 79 cents. Mid-West Abrasive Co., Owosso, Mich.



COILED NYLON AIR HOSE pulls out to 20-foot working length and is self-storing in one foot without a reel. You can use it with any compressed-air tool at pressures up to 200 pounds per square inch. Flexible nylon is impervious to oils and won't kink in use. Synflex is supplied with re-usable fittings and a spring guard to prevent crimping. Price, \$9. Samuel Moore & Co., Mantua, Ohio.

**WHAT'S
NEW.....**



SHOCK-ABSORBING HAMMER has a non-rigid head suspended on elastic rings that minimize the force of impact on your wrist and arm. Shure-Drive was designed for use with Shure-Set, a plunger tool for driving masonry drills and stud fasteners directly into concrete [PS, May '58], but is handy also for other work on masonry and hard metals, reducing rebound and thus delivering more power. The new hammer has an oval-shaped tubular-metal handle covered with nonslip neoprene. \$9.95. Ramset Fastening System, New Haven, Conn.

106 POPULAR SCIENCE AUGUST 1960

**Car-Top
Kitchen
Slides
on Rails**

This camp cabinet fits in a wood frame mounted on the car top by suction cups and tied down with straps clamped to the rain gutter. The lid opens to a 2½-by-3-foot table. The section remaining in the frame can hold a cook stove.

It's designed for a Volkswagen, but fits other small imports. Complete, \$67.50; do-it-yourself plans, \$2. Howard Kirkpatrick, 17112 Keswick St., Van Nuys, Calif.

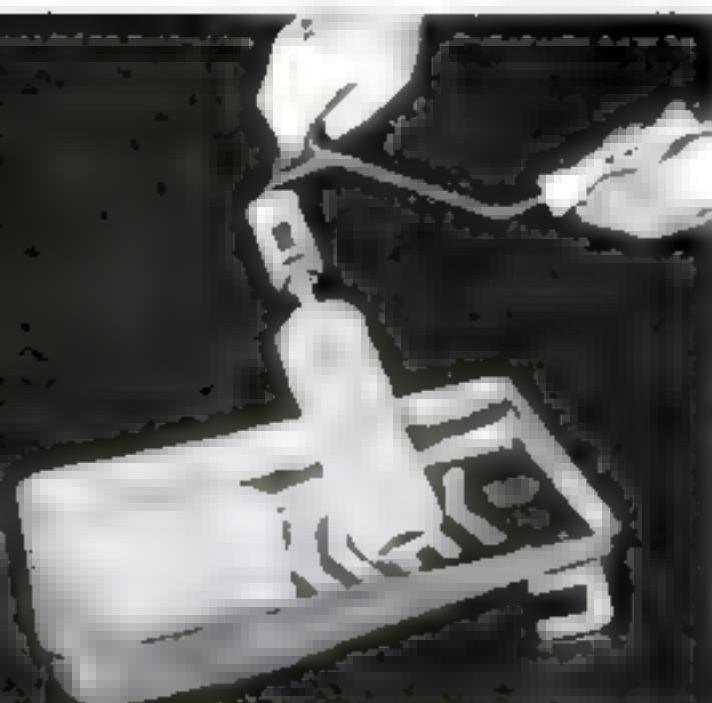
HAND RABBETER is powered by portable drill to recess picture frames, slot bottoms of drawers, and tongue-and-groove table tops and flooring. Its angled guide adjusts for depth and width of cut. Temperleys, Haslehurst & Co., 425 Howe St., Vancouver, B. C.



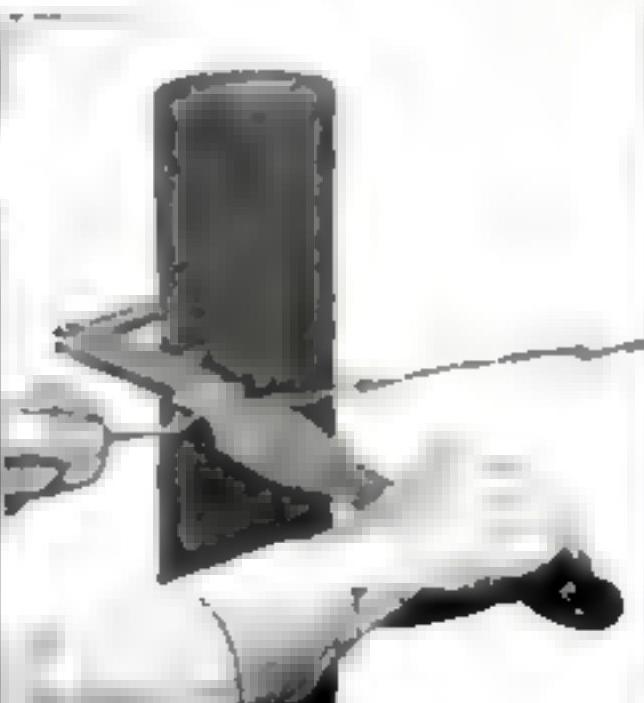
MASKING PAPER is eight inches wide with one adhesive edge for attaching next to a surface being painted. It leaves a clean, sharp line, is useful for spraying, or brushing if you can't trust the steadiness of your painting hand. A 30-foot roll costs 98 cents; a 90-foot roll, \$1.98. The Leonard Co., 506 Third St., Des Moines, Iowa.



GEARSHIFT AND THROTTLE are combined in a single lever for remote control adaptable to the standard cables of 70 percent of the outboards in use. Whitney Automatic has a nylon drive gear, gear rack, throttle bar, drag link, and bushings, eliminating metal-to-metal contact and making lubrication unnecessary. \$39.95. Lake Controls, Buffalo, N. Y.



ROLLER TRIGGER ejects paint sleeve automatically. Plastic cover on frame simplifies cleaning. Frames come in seven- and nine-inch sizes at \$3.90 and \$4.45 with tray and sleeve, or they can be purchased separately. Rollers by Baker, Inc., Brandon, Vt.



WIRE STRETCHER is equipped with a lock that holds wire to any kind of post and lets you put up a tight fence without help. You simply leave it in place until you drive in the staple. It sells for \$5.95. Grosco, Inc., 626 E. Locust St., Des Moines, Iowa.

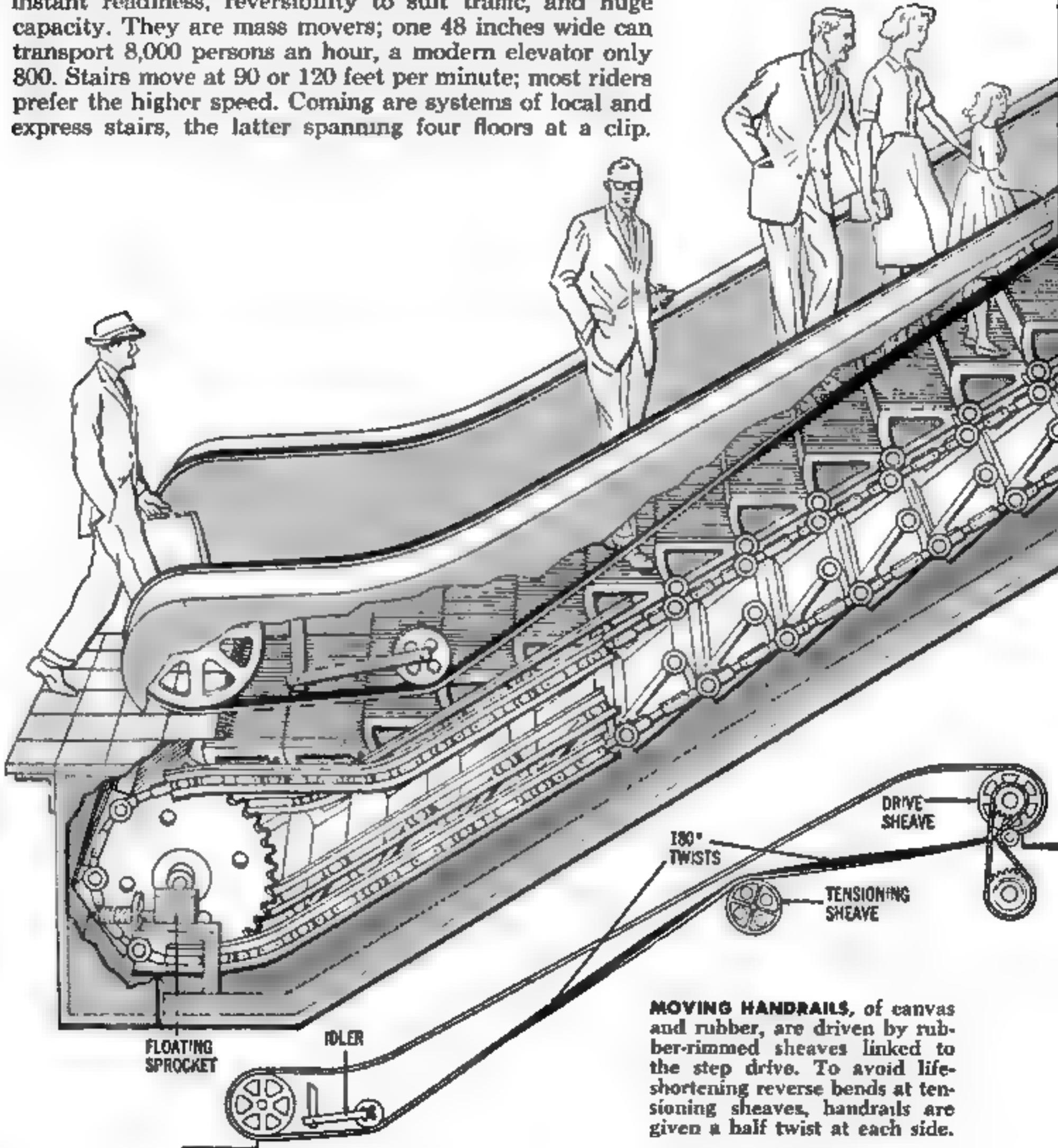


GAS LANTERN uses propane fuel in a replaceable cylinder. It reflects an adjustable light beam to the front and sides and in a circle on the ground. Pyrex globe needs no cleaning. Price, \$14.95; extra cylinder, \$1.94. Otto Bernz Co., Inc., Rochester, N. Y.

How an Escalator

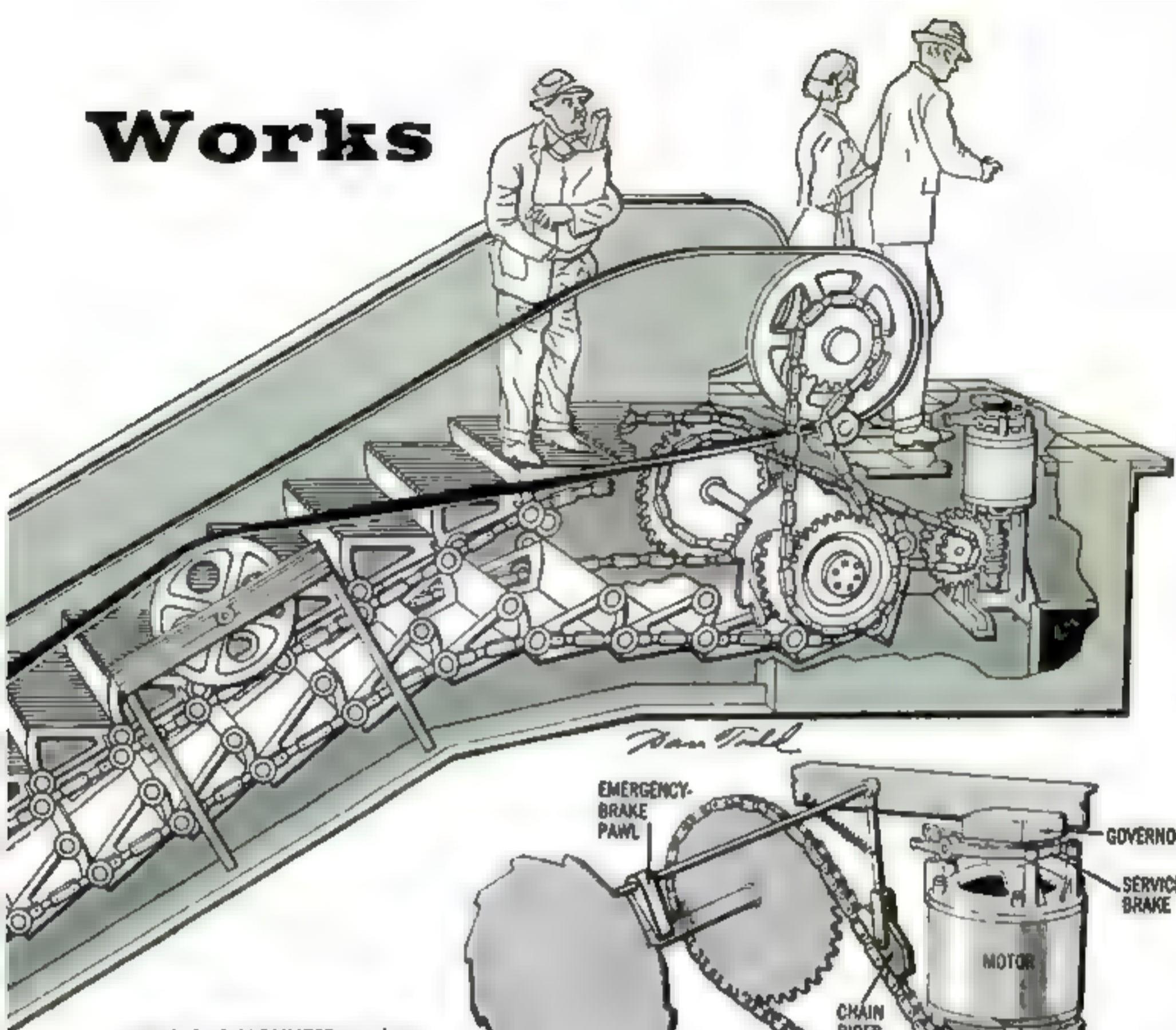
CONVEYOR belts for people date from 1891, when Jesse Reno patented cleats to stand on, and Charles Seeberger designed a belt with horizontal steps you had to get on and off sideways. The world's first practical moving stairs were installed in 1900 at the Paris Exposition and in the New York subway.

Their big advantages over elevators are compactness, instant readiness, reversibility to suit traffic, and huge capacity. They are mass movers; one 48 inches wide can transport 8,000 persons an hour, a modern elevator only 800. Stairs move at 90 or 120 feet per minute; most riders prefer the higher speed. Coming are systems of local and express stairs, the latter spanning four floors at a clip.

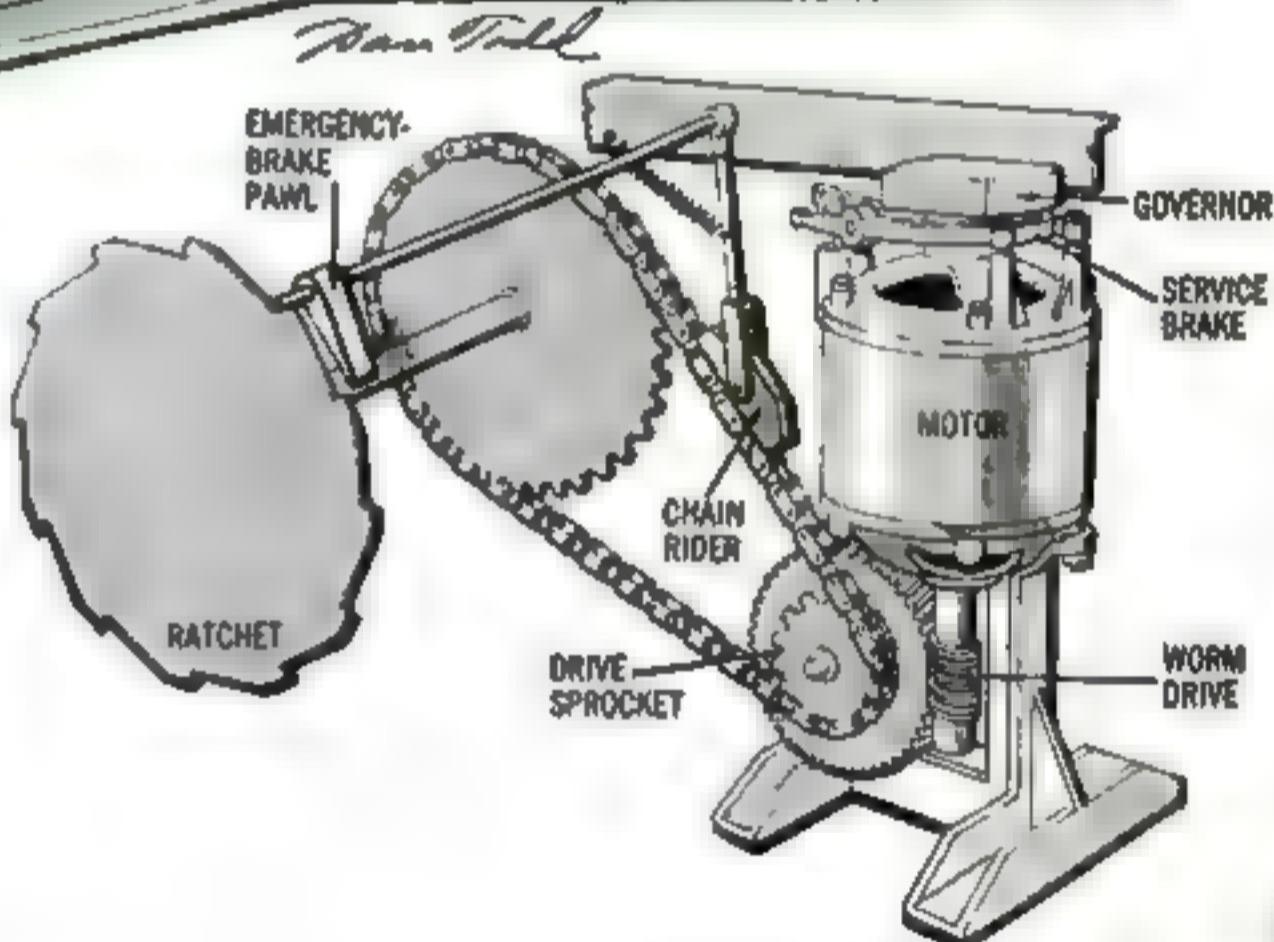


MOVING HANDRAILS, of canvas and rubber, are driven by rubber-rimmed sheaves linked to the step drive. To avoid life-shortening reverse bends at tensioning sheaves, handrails are given a half twist at each side.

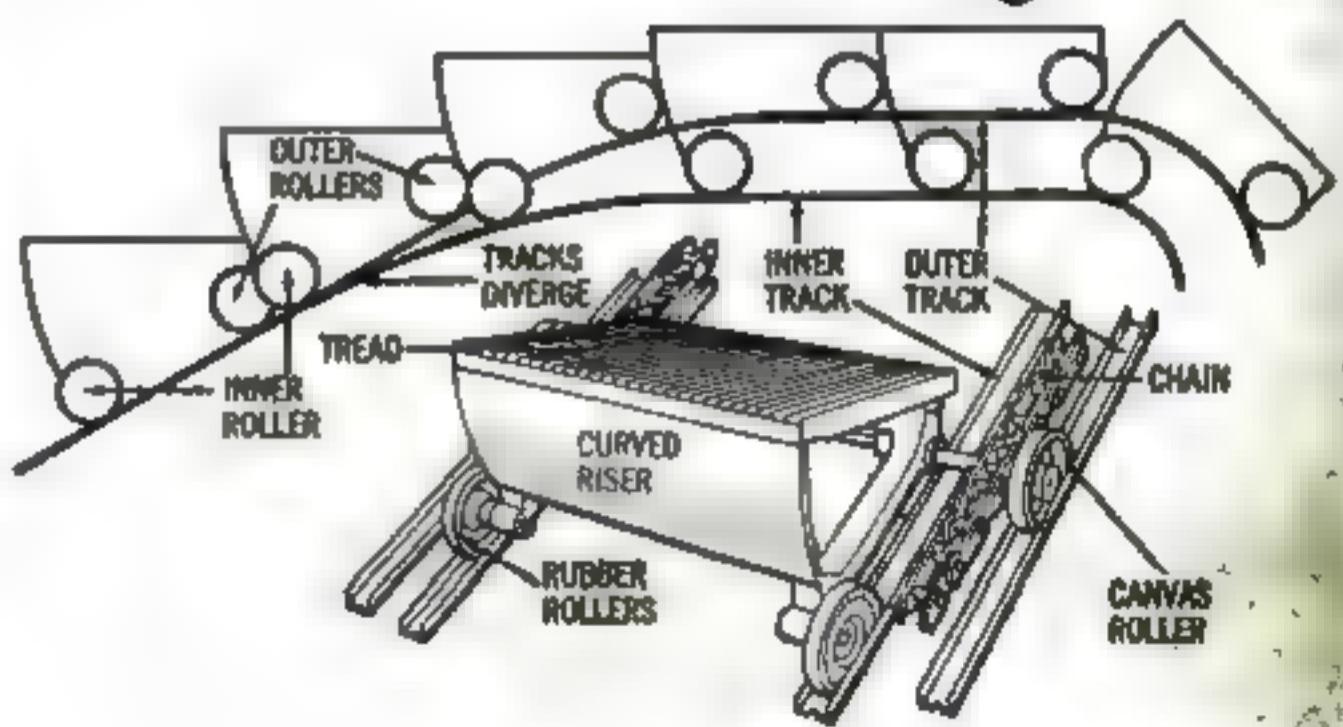
Works



STEPS ARE MOUNTED on two chains driven by sprockets at the top. Lower sprockets float against springs; if a chain breaks or jams, they cut power, set the service brake. Should drive chain break (right) rider drops, sets emergency-brake pawl.



SECRET OF TREAD ACTION is that each step has four wheels, two at the bottom of the riser riding inner tracks, two under the opposite tread edge. These ride a second pair of tracks outside of the first. On the incline, both tracks lie side by side. Where the outside ones level off at landings, the inner tracks are below them, letting the riser drop so that tops of the tread line up.





1. STAINLESS STEEL to be shaped is placed over open end of a heavy die in the laboratories of Canadian Industries, Ltd., at McMasterville, Que. The concentric rings aid in measuring effects of the explosion.

Blasting metal into shape

How the technique of forming metals by explosion works is shown in this photo sequence. The method originated in U. S. research laboratories and is being used experimentally by aircraft and other plants here and in Canada for shaping new, tough alloys that are difficult to work by ordinary means. Some of the parts made successfully by the process are rocket-booster cases, jet sound-suppressor tubes, and fuel tanks.

In the experiment shown here a small amount of pentolite, a relatively new explosive, was suspended in a frame a measured distance above the sheet to be formed. It was detonated under water. Displacement of concentric rings on the sheet helped scientists to study the effects of the blast.



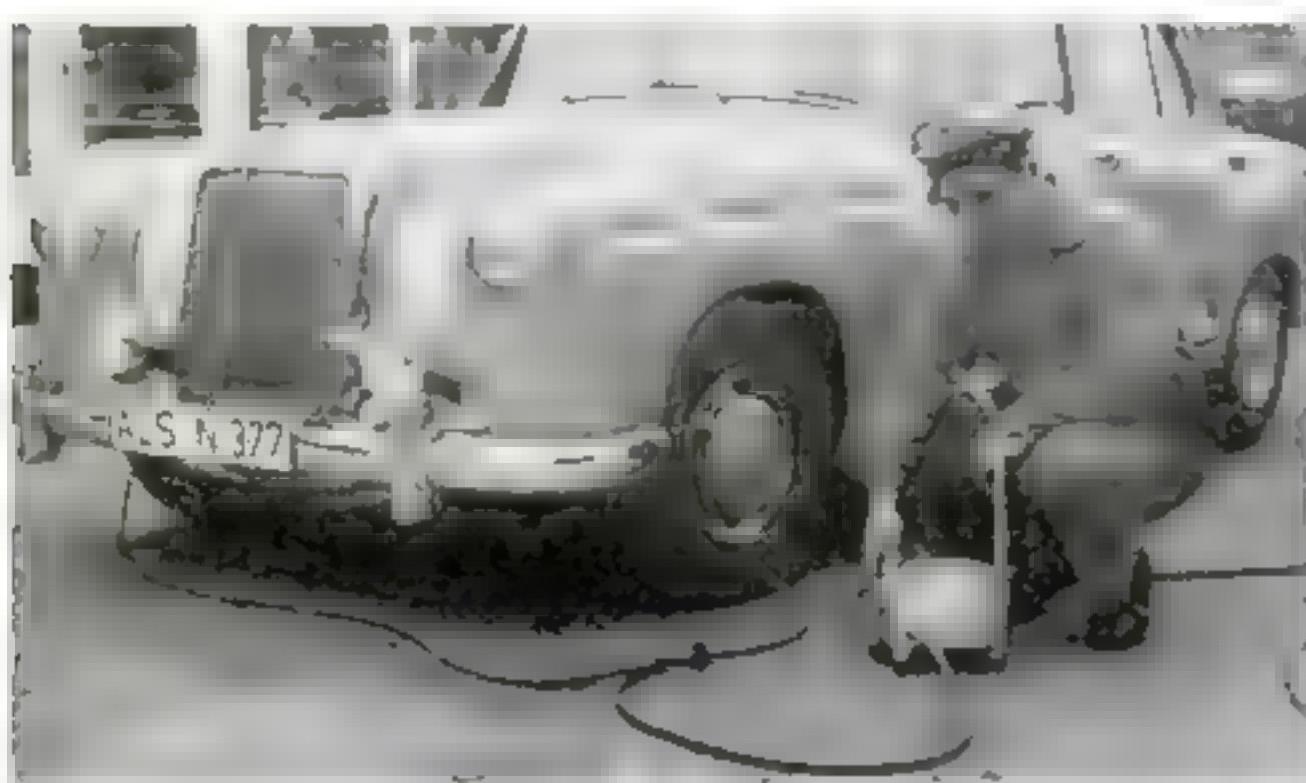
2. PENTOLITE CHARGE is set on a rack attached to a ring covering die, with the sheet sandwiched between the ring and die. Explosive charge is then lowered into the water.



3. UNDERWATER BLAST sends up gusher of spray from the surface of the water-filled forming tank.



4. SYMMETRICAL RESULT is attained much quicker by explosion than by machining or stamping in a press.



Tire equalizer

Motorists who are extra-fussy about having exactly the same pressure in each tire might patronize a service station equipped with this German device. It inflates two tires at the same time.

The unit is portable and attaches easily to standard service-station air hoses.



SUBMARINE RADOME on hinged boom begins fall into a Massachusetts quarry pond. The wedge-shaped brake at top of the boom will bring the drop to a halt 25 feet below the surface.



SMASHING IMPACT with the water simulates the action of heavy seas. Other tests are planned for missile capsules, recovery systems, ejection seats, and various hull elements.

Water-battering test for submarine gear

How well the radome that helps navigate Polaris submarines can withstand the impact of heavy seas is being tested in an abandoned quarry in Gloucester, Mass.

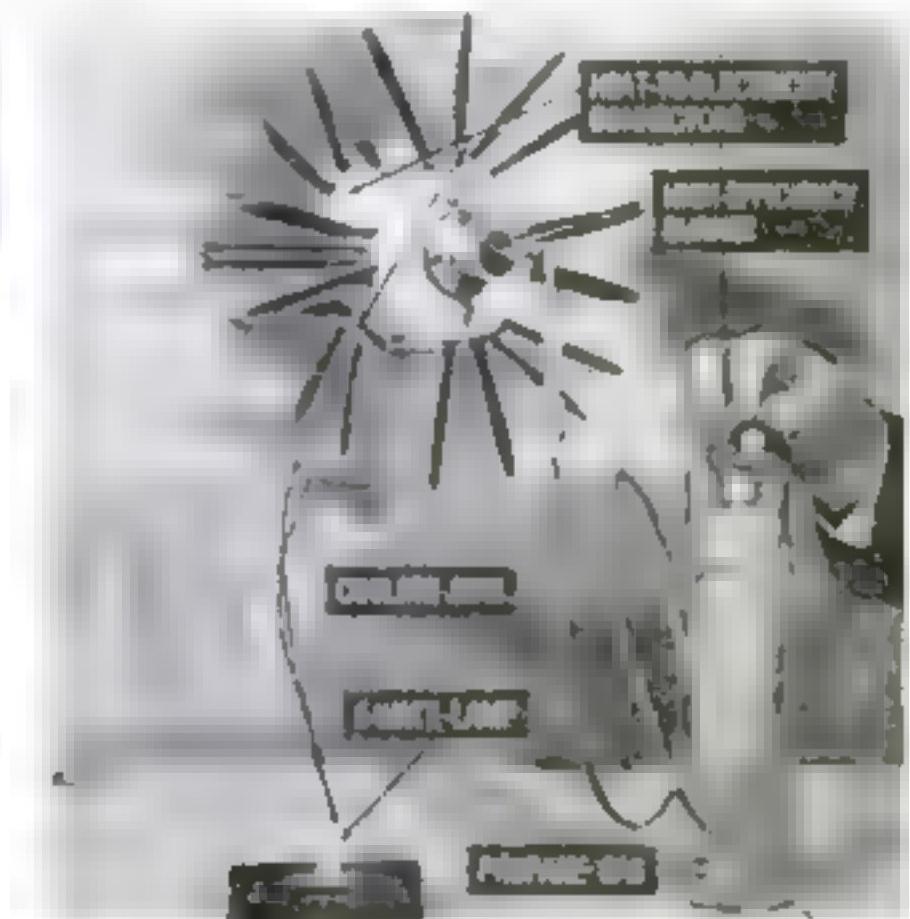
The radome is attached to a 40-foot steel boom set on a huge hinge that is held to the granite face of the quarry by 64 six-foot bolts. Water depth is 40 feet.

Velocity of impact varies with the height of the fall. Pressure, stresses, and other forces are measured by instrument, and the action is recorded by an underwater movie camera. After each drop, the boom is raised by a winch. The tests are conducted for the Navy by Allied Research Associates, Inc., of Boston.



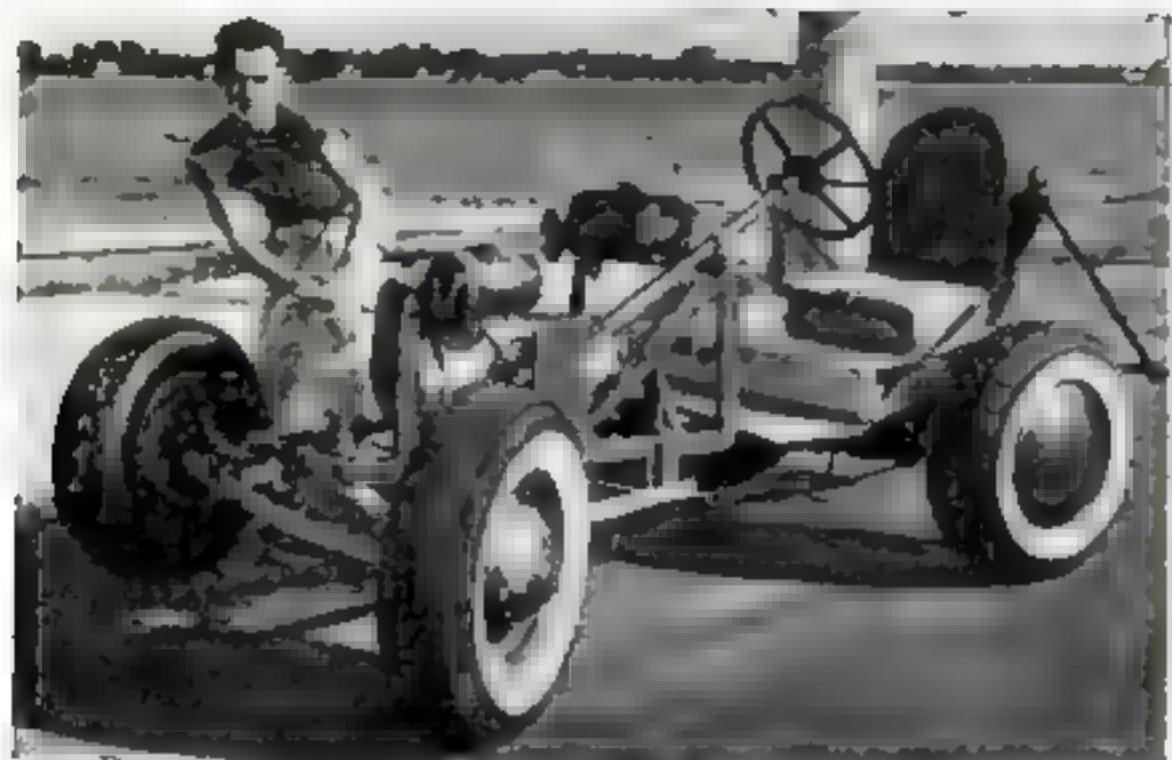
Doll-size television

This miniature TV set really works. Its 1 1/2-inch screen gets clear pictures on both BBC and independent channels. Charles Wilson, a dealer in Bedfordshire, England, built it in his shop in nine months of spare time. It's not for sale. Wilson has refused an offer of \$1,000.



Electricity from a flame

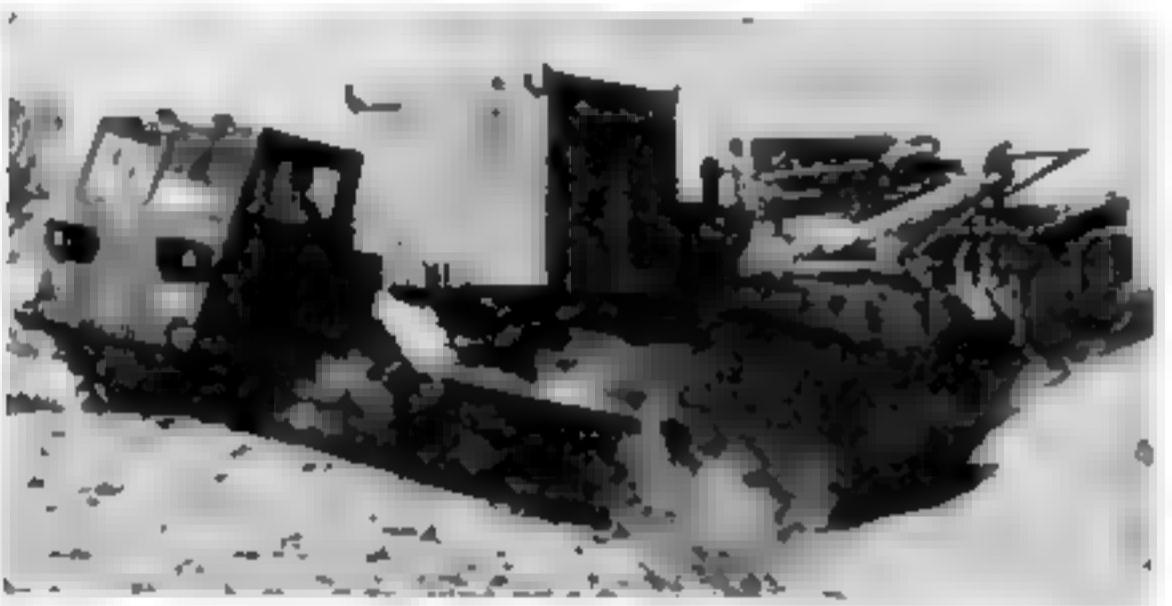
A gas flame makes electricity directly—no generator—in this thermoelectric converter. Intended to power beacons and instruments in remote places, it will produce five watts for a year on one \$10 tankful of propane. General Instruments Corp., Newark, N. J., developed it.



Grown-up kart

A six-hp. marine engine, a homemade frame, and parts from a wide assortment of cars make up this out-size version of the lawnmower-engined karts.

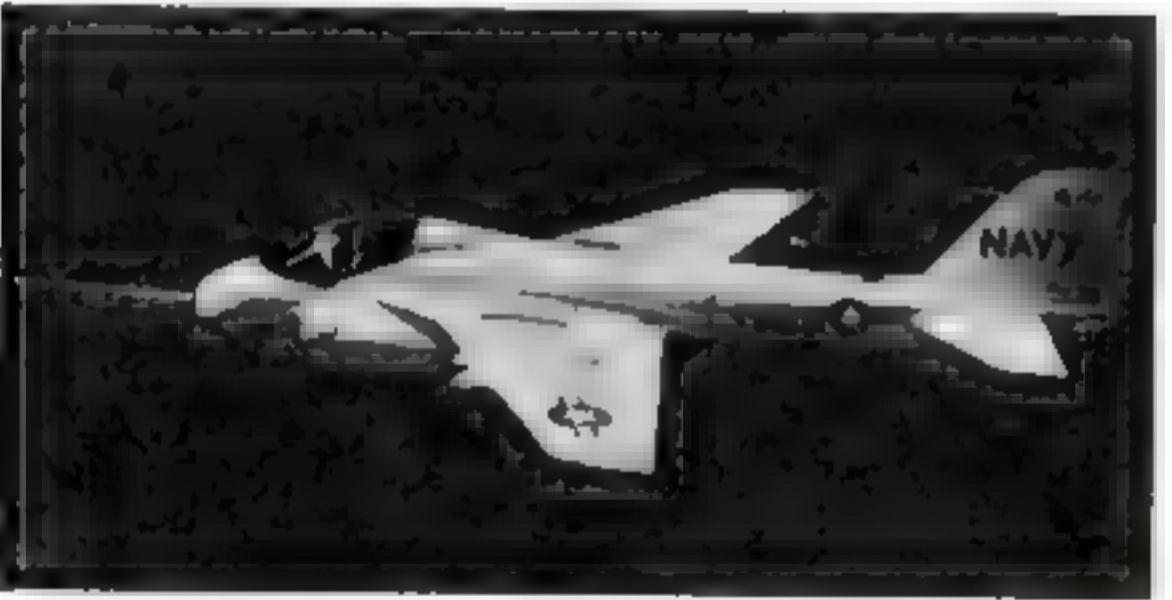
Built by 17-year-old Hal Cochrane of West Palm Beach, Fla., the contrivance has a three-speed transmission, a hand throttle, and two fuel tanks. It is licensed in a class with small foreign cars.



Ultra-light steel

T-1, a light, super-tough alloy steel, makes possible the building of this rugged, air-transportable Army missile erector and launcher.

The new alloy, developed by U.S. Steel, is heat-treated to a strength of 100,000 pounds per square inch, triple that of structural carbon steel.



All-weather plane

Targets obscured by weather or darkness are pinpointed on two viewing screens in the cockpit of the Grumman A2F-Intruder, a new Navy bomber.

Designed to fly at Mach .9, the low-level bomber is equipped with down-tilting tailpipes for extra lift in takeoffs from carriers and short airstrips.



Dangerous game

A room full of formaldehyde gas provides the setting for the volleyball game at left. The players, members of a rescue team at a coal mine near Birmingham, Ala., keep in condition for emergencies this way—by exercising while wearing gas masks.



Want to swim in two weeks? A fast, cheap method now promises you a—

Full-Size Pool for Only \$300

By Franklin Folsom

YOU can build a 20'-by-30' swimming pool for less than \$300. Start work tomorrow and you can take your first dip within two weeks. The pool should be as good as ever 10 years from now, with little trouble and expense for upkeep.

I know. I built what has been called the first poor-man's pool. Many others have been modeled on mine. Enthusiastic fans report excellent service from such pools in places as diverse

ASPHALT-STRIP POOLS require only a hole, lining—and water. The huge 30-by-60' pool above was built in two weeks by John H. King near Washington, D.C., has lasted more than 10 years.



DIG A HOLE



LINE IT



SWIM IN IT

CONTINUED

as western New York state, Virginia, Texas, southern New Mexico, northern Massachusetts.

Some of the pools are drained, cleaned, and refilled from two to four times a season. If water is limited you may need to add the cost of a recirculating filter to the original figure. In one 50,000-gallon pool I know of, a \$200 filter has served well.

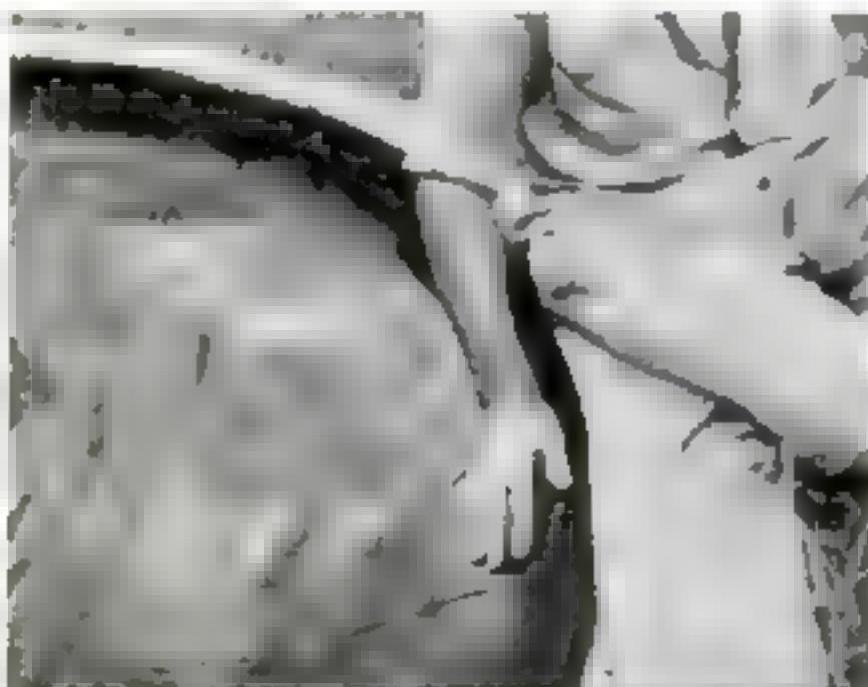
What's the secret? The method has been successfully used for many years as a quick, inexpensive way of building farm ponds, canals, and dams, but so far as I know, my wife and I were the first to apply the technique to a swimming pool.

You dig a hole, line it with asphalt-impregnated strips, cement them together, and they form a tough, watertight bottom. A single layer of strips is sometimes used in ponds. But a single layer might not be enough for a pool.

In our first pool, we used three layers of heavy 90-lb. roll roofing covered with ground slate. Thirty-five rolls gave a triple-thick lining for a pool with sloping sides the size we wanted. Including tar to hold the layers of paper together, plus a few other incidentals, the cost came to \$250.

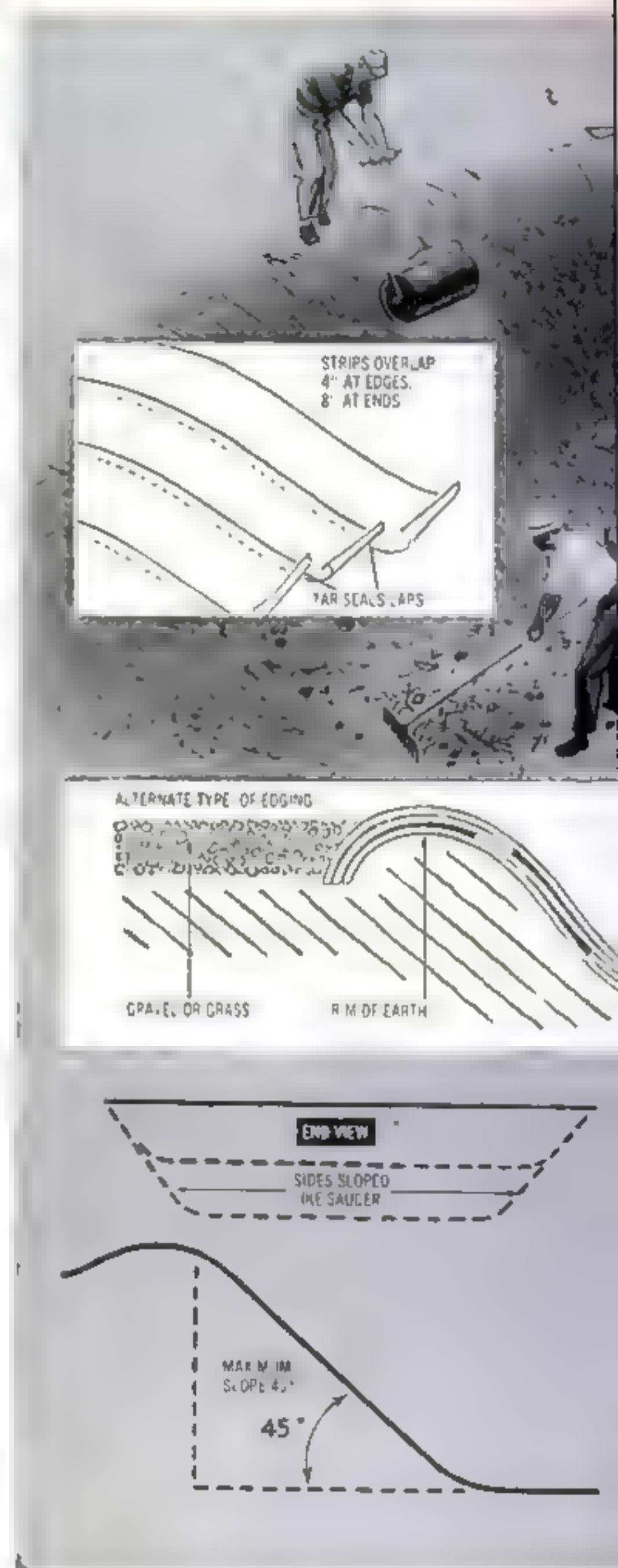
That was in 1944, more than 16 years ago. When we had used our pool for five years, an article on it appeared in a nationally circulated Sunday supplement. Inquiries poured in. Soon pools began to spring up all over the country.

How they've stood up. Most of these

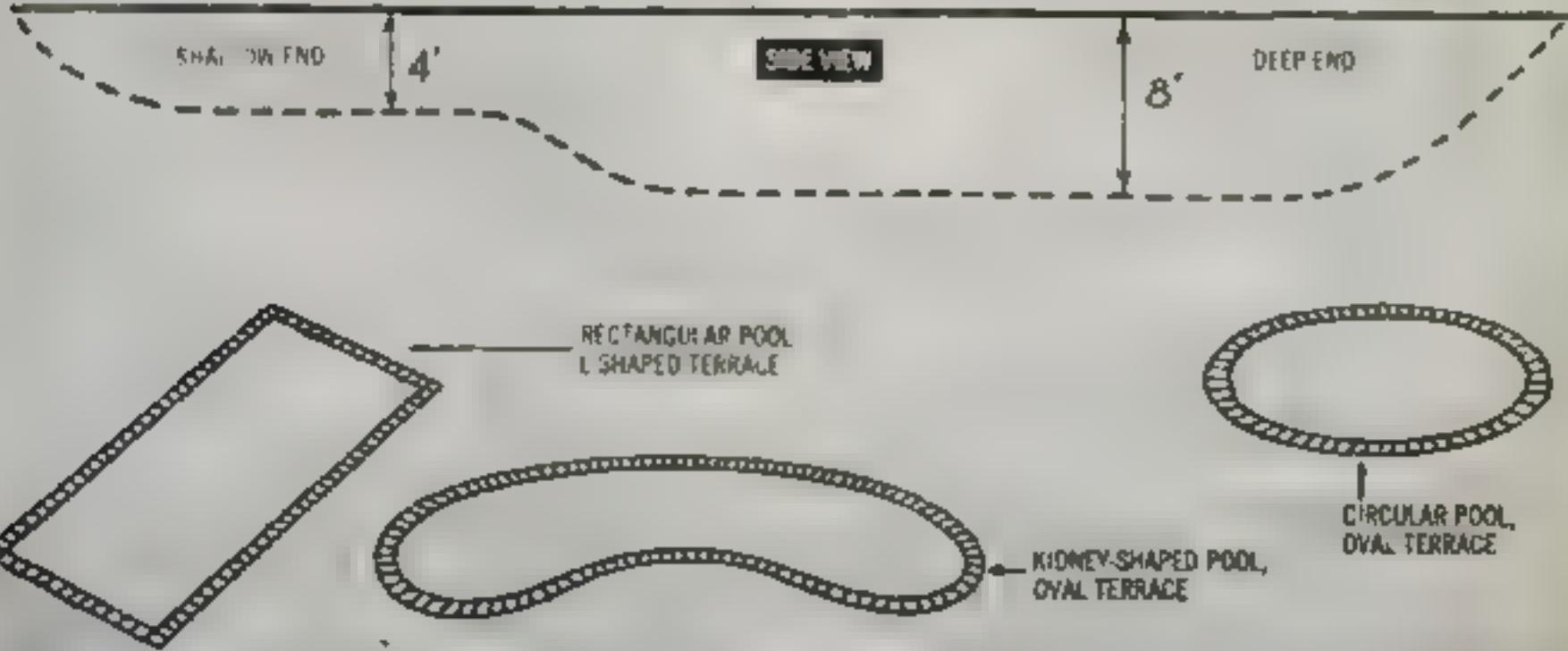
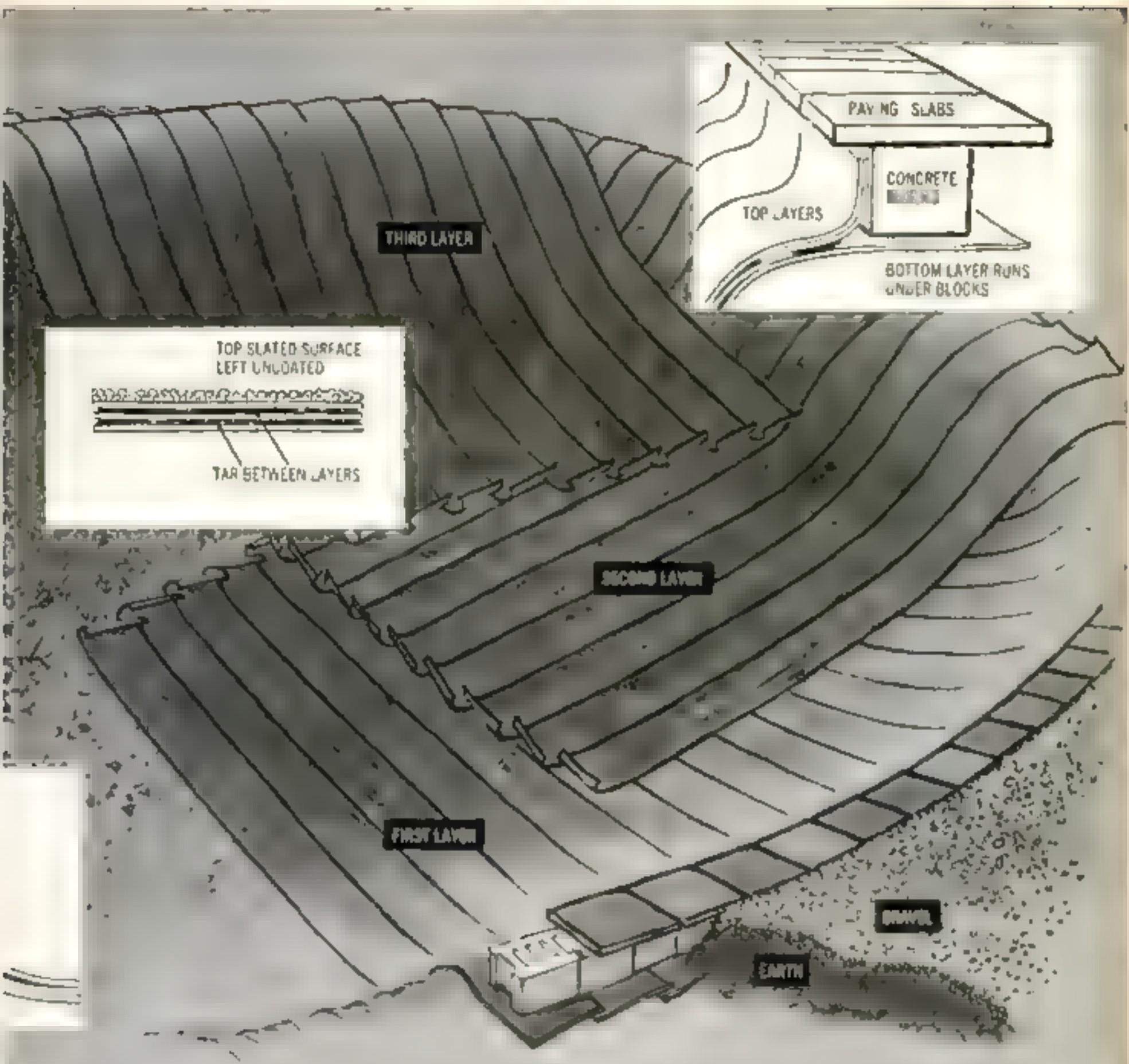


YOU CAN DRESS UP THE EDGES of an asphalt-strip pool to look as attractive as any other type. Here, the bottom layer of strips is run under a row of concrete blocks and the next two layers are cemented to the face of the blocks, as in upper sketch on opposite page.

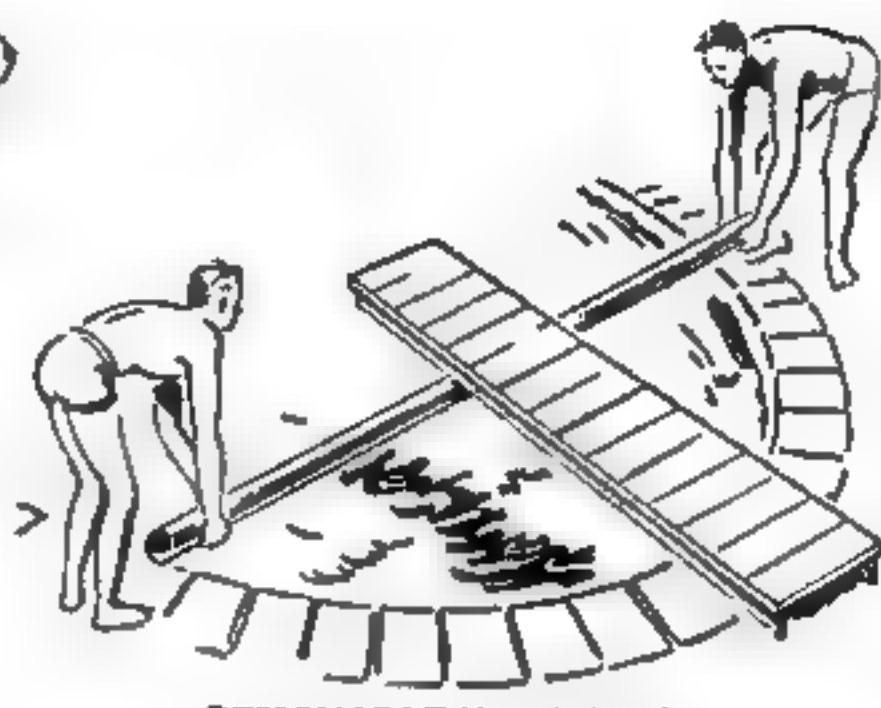
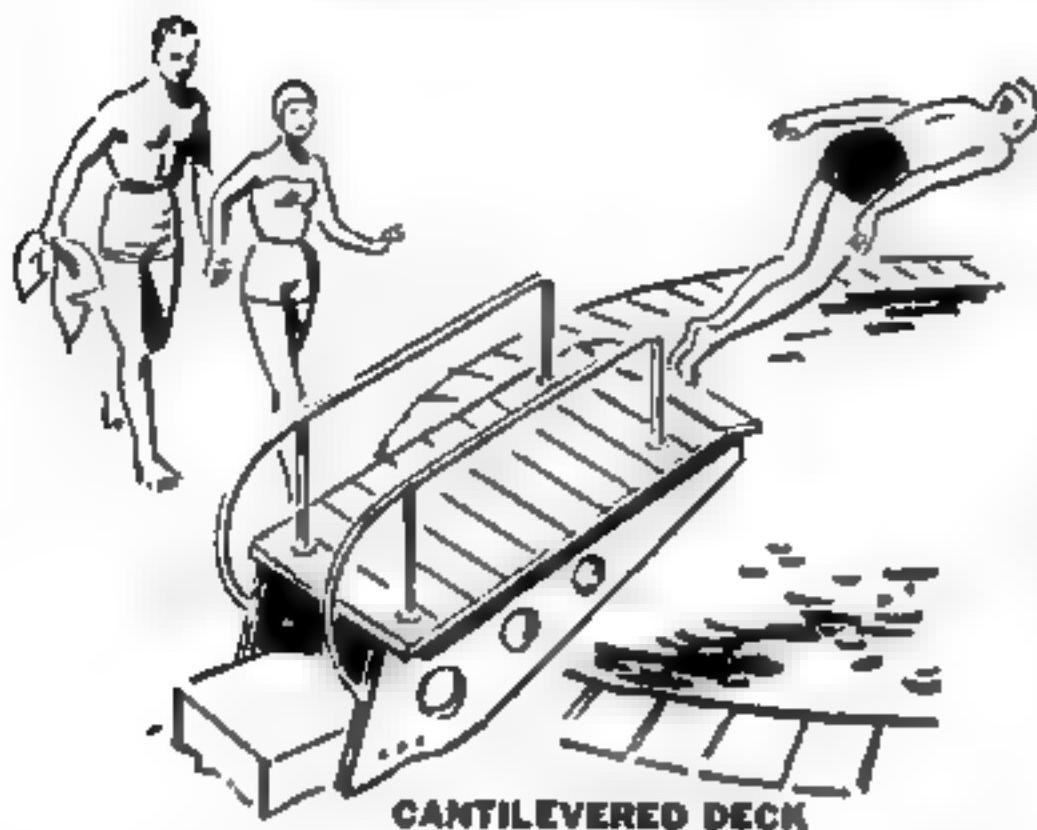
How the layers of asphalt



strips are built up to form a watertight pool bottom



Rafts and decks add glamor to an asphalt-strip pool



pools are now at least 10 years old and are still going strong. The construction has proved so tough that one pool, built by R. M. Myers of Akron, Ohio, refused to budge when bulldozers attempted to break it up to clear the way for a new road. It had to be broken up by hand.

Myers has since built a second, even bigger, pool: 40' by 50'. It cost him less than \$200 in 1955. Another mammoth pool, a 30-by-60 footer, was built by John H. King, near Washington, D. C. Total cost at 1950 prices: \$380. Both pools were built in less than two weeks.

Perhaps the biggest asphalt-strip pool on record is George J. Ruppert's 40'-by-70' jumbo in Burlington, Mass. He operates a day camp and for the past 10 years during the summer 300 children and adults have been splashing in it every day. A pool in New York has been used for 10 years as a winter skating rink.

Waterproof liners. While these early pools are all made of ordinary roll roofing and have lasted well, an even better material to use may be a special product called canal liner or pond liner. This is a waterproof, asphalt-impregnated membrane that's made for lining ponds and irrigation canals. It's similar to roll roofing except that it has a smooth, unslated surface and is especially designed to resist rotting and leakage.

Canal liner can be ordered through local lumberyards and roofing dealers. It comes in the same size rolls as roofing—

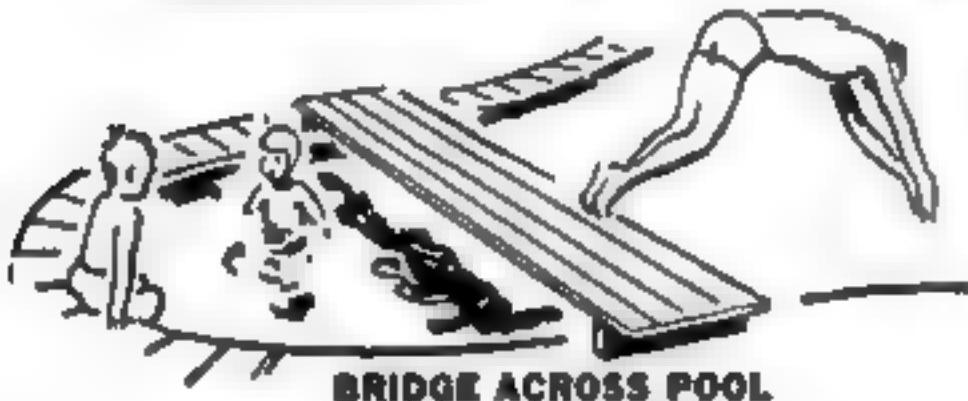
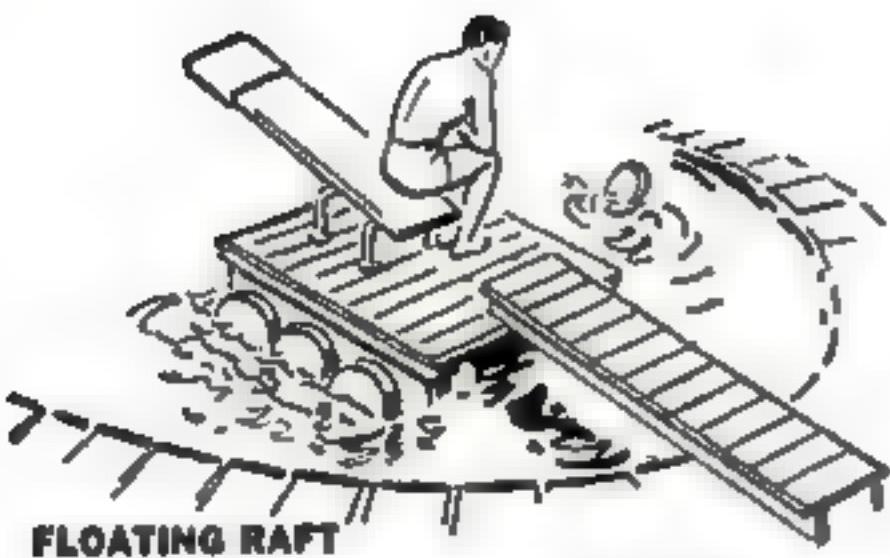
36" wide and 36' long. Each roll, allowing for overlap at the seams, covers about 90 square feet.

There's a guess, although nobody is sure yet, that two layers of canal liner may do the work of three layers of 90-lb. roll roofing. This could save labor, but the cost would come out about the same since canal liner is a little more expensive than roll roofing—about \$4 to \$4.50 a roll compared with \$3.50 to \$4 a roll for roofing. I've seen one two-layer pool come to grief and I'm convinced that three layers are important no matter what the material.

One caution: If you do use canal liner, be sure to get the special canal-liner cement that's made to go with the brand of liner you buy.

Determining the shape. My pool was roughly rectangular, 45' by 27'. At one end the depth was 18" for kids and at the other end 6' for diving. Keep in mind that the steeper the slope on the sides, the harder it is to lay the strips and the more likely they are to be heaved by frost. Where the bottom of the pool meets a side, or at corners, shape the earth into a curve, not a sharp angle.

Several people have asked me how to determine the pitch of the slope. I didn't determine the pitch in my pool. Nature did. A heap of loose earth tends to assume its own natural slope. That was good enough for me. As a general rule, however, designers of canals and ponds



say the slope should not be steeper than about a 1-to-1 pitch, or an angle of about 45 degrees.

If the sides of the pool are very shallow, you may find it unsafe to dive in from the edges. There are several ways you can get around this with floating rafts or cantilevered diving decks.

Scooping out the hole. A bulldozer can scoop out a pool the size of mine and even larger in half a day. Do not depend on your eye to tell you when the hole is deep enough. Measure. Cut a board to match the depth of the deepest part of your pool. Stand the board upright at the deepest point and stretch a cord between the top of the board and the rim, using a level to determine which points must be built up or lowered to make the rim level all around.

I installed a standard swimming-pool drain fitting at the lowest point, with a 2" pipe running out under the bottom. Smooth out the earth at the bottom of the pool, sloping it toward the drain pipe. A collar of cement about 2" in diameter and 4" thick around the drain fitting will keep it from shifting. It should be coated with tar to prevent leaks.

Laying the asphalt strips. While it's possible to dig a hole and start laying the strips the same day, it's better—if you can postpone your swim—to let the soil settle for several months and become stable. If you can't wait, you can shorten the settling time by soaking the earth

and tamping it solid. Clear out sharp stones and rake the earth smooth.

I laid the first layer of asphalt roofing directly over the bare ground. The strips were overlapped 4" at the edges, with cold liquid tar brushed under the laps. It's best to choose a hot day because the strips are softer to work with and the tar dries quickly.

At the edges of the pool, the asphalt strips should be carried at least 2' up and over a raised rim of earth—like the crust of a pie—to lock the ends in place. Dirt, gravel, flagstones, or other paving materials can then be placed over the ends of the strips to conceal them.

At the corners, I tailored the strips to fit by slitting them with a knife and overlapping the edges so they would lie flat. At the drain, I cut a snug hole in the roofing to fit over it.

Crisscross the layers. Before laying the second layer of strips, I smeared tar over the first layer, a strip wide at a time. The second layer of strips was then set in this tar, at right angles to the first strips to reinforce the seams.

The third layer was laid in the same way—at right angles to the second. Care must be taken to lay the strips flat with no wrinkles or bulges.

How much asphalt? The area of a pool's bottom varies according to its depth, but here's a rough rule:

[Continued on page 198]



SLOPING SIDES may or may not permit diving depending on the angle, but depth is no problem. This huge 40'-by-50' pool, built by R. M. Myers of Akron, Ohio, is 8½' deep at the center—plenty even for a high dive. Note how seams, coated with tar, are almost invisible.

My PRIZE project is...

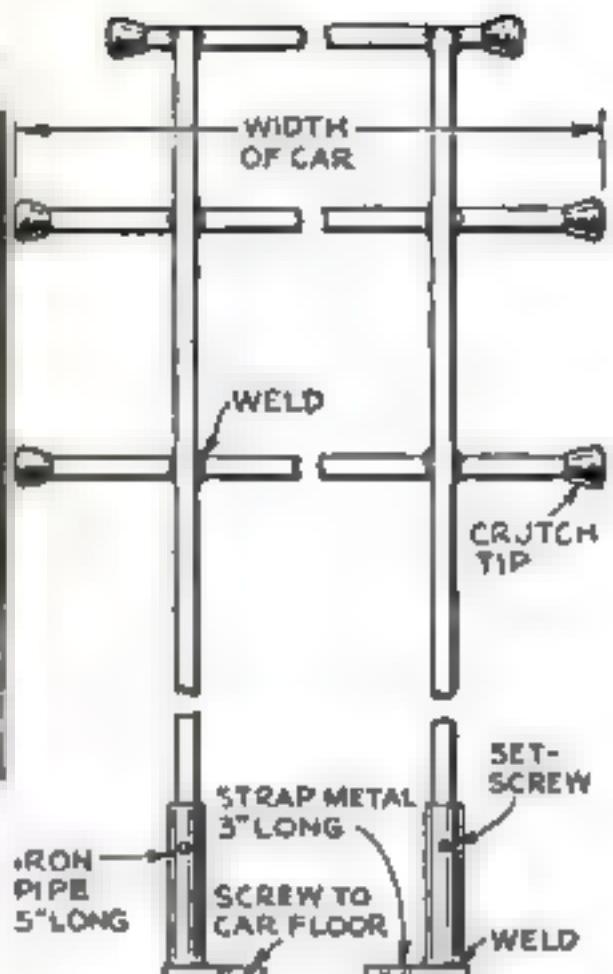


...a back-seat fence for my dog

Dogs love to ride in a car. But when the dog happens to be huge, like mine, things can sometimes get out of hand, especially in traffic. So I devised and built a wrought-iron fence to keep him

safely in the back seat. The uprights fit into iron-pipe sockets screwed to the car floor. The guard can be lifted and removed from the car.

R. P. STANFORTH, DeLand, Fla.

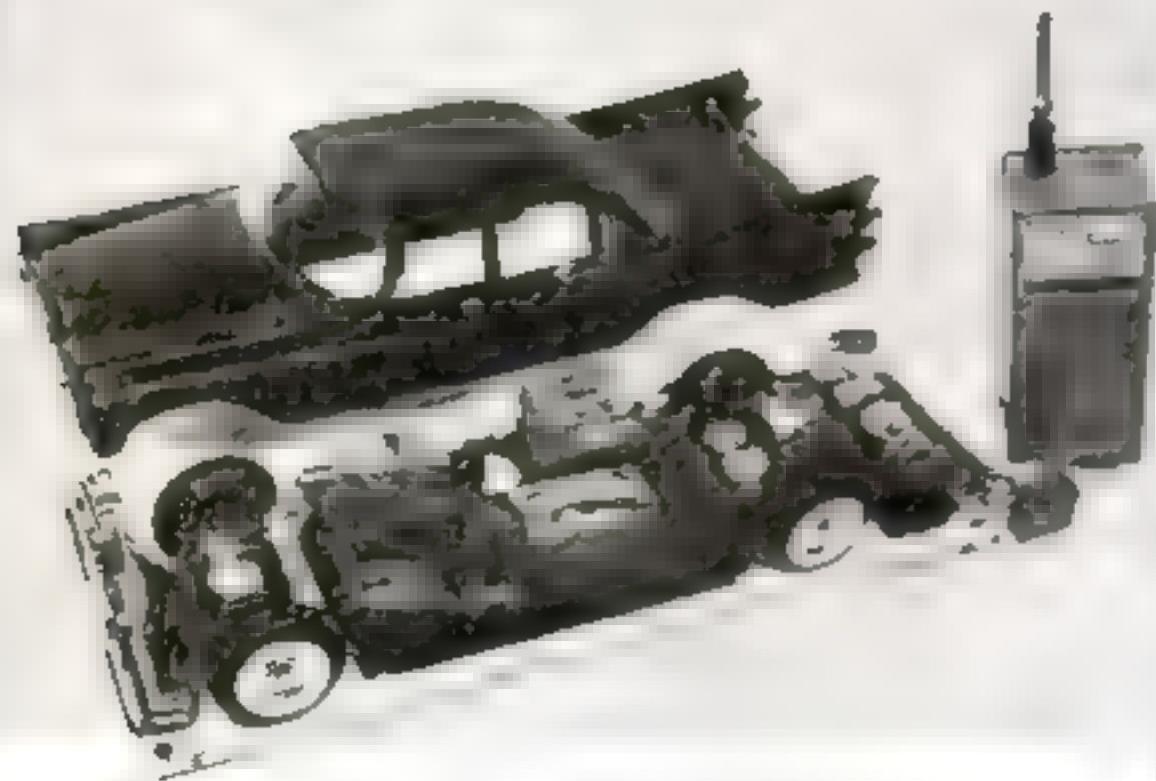


...a radio-controlled car

IT TOOK a year, but I've now completed a radio-controlled scale model of my 1958 Dodge Coronet. It is 26½" long and is made from balsa with metal for such accessories as bumpers and trim. It's finished in black enamel.

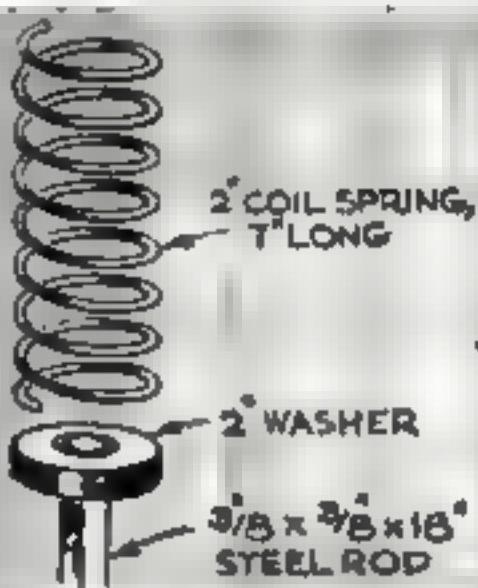
A single-channel transmitter provides right turn, left turn, forward, reverse, and stop. All lights on the car work, including the turn indicators when a turn is made.

VINCENT VENZA SR.,
Nutley, N. J.





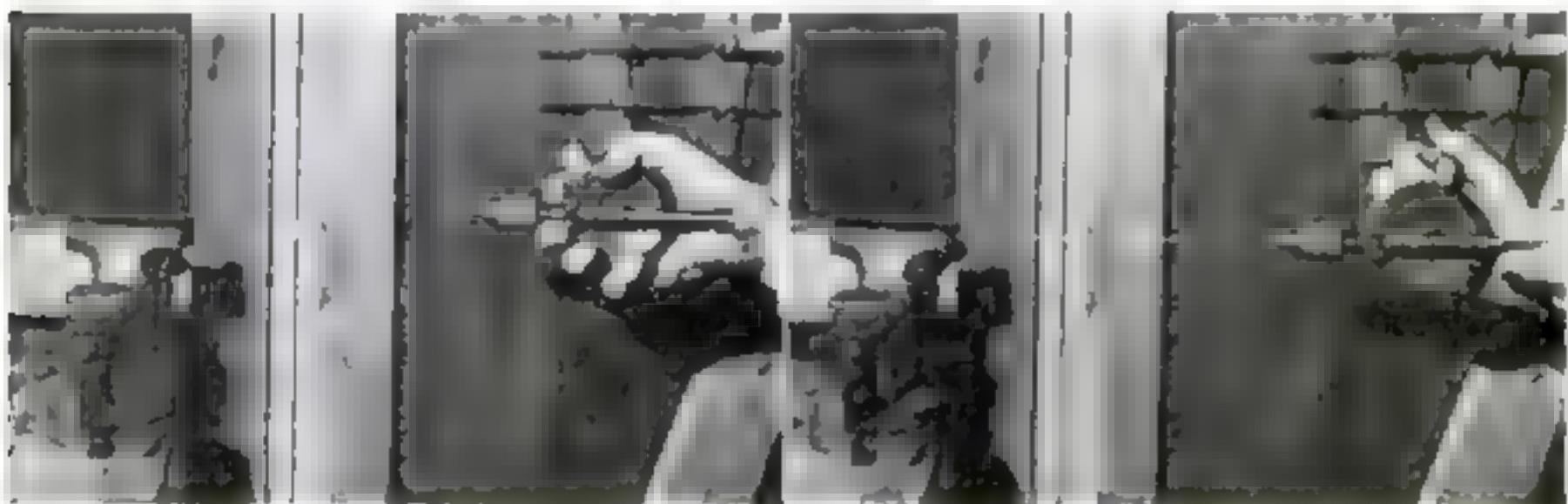
**Short Cuts
and Tips**
FROM PB READERS



Rod Holder for Surf Fishing

THESE surf-rod holders are a practical addition to any fisherman's kit. They are the work of John W. Crowe, South Fort

Mitchell, Ky. He made them by welding a 2" washer to an 18" length of $\frac{3}{8}$ "-square steel rod and then welding 7" of 2" coil spring to the washer to hold the rod.—*Jack Dermid, Raleigh, N.C.*



Tip for Straightening Wire

Any piece of wire up to several feet long can be straightened by this effective trick, provided it doesn't have a

definite kink. Hold one end in a vise, chuck the other in a hand drill. Give it two or three turns as you pull hard and the wire will come straight.—*Erik Miller, Sherman Oaks, Calif.*

Picnic Table Rolls on Wheels

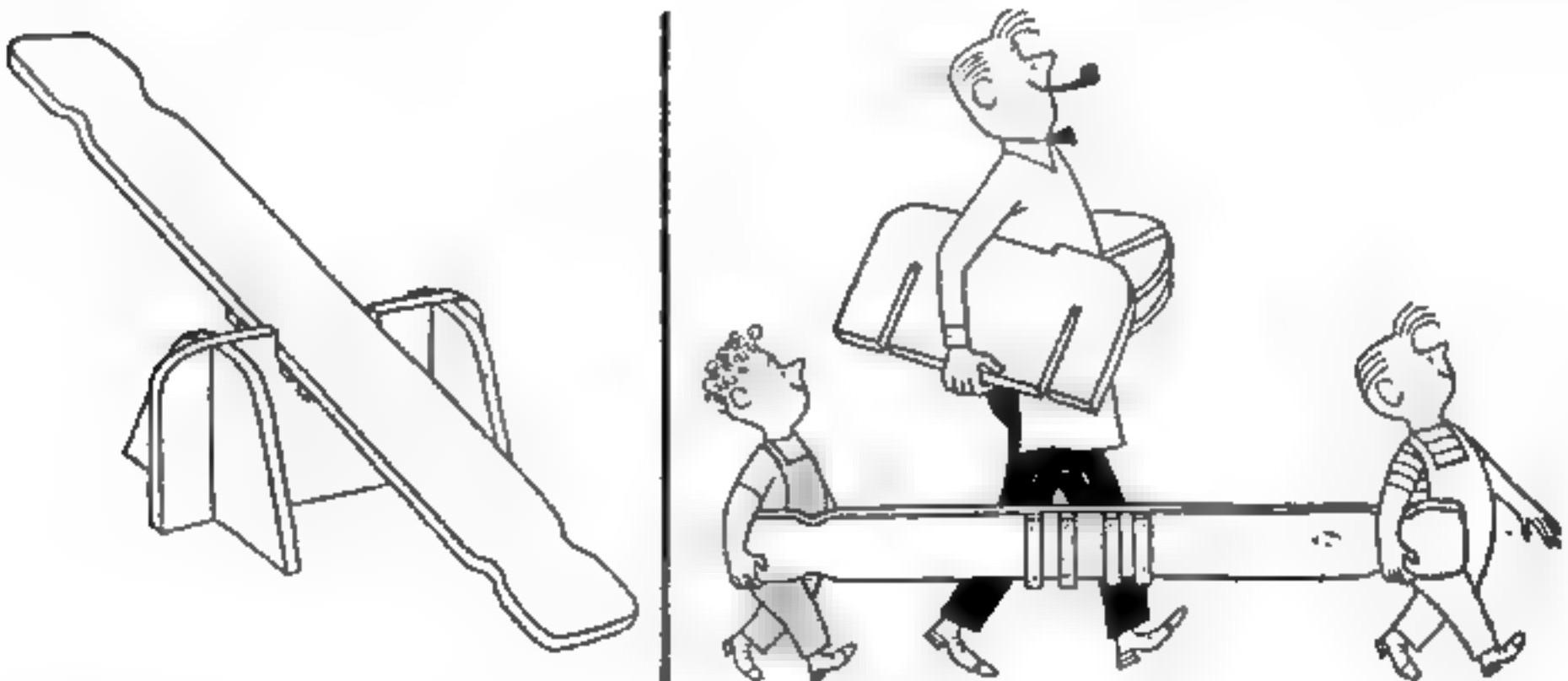
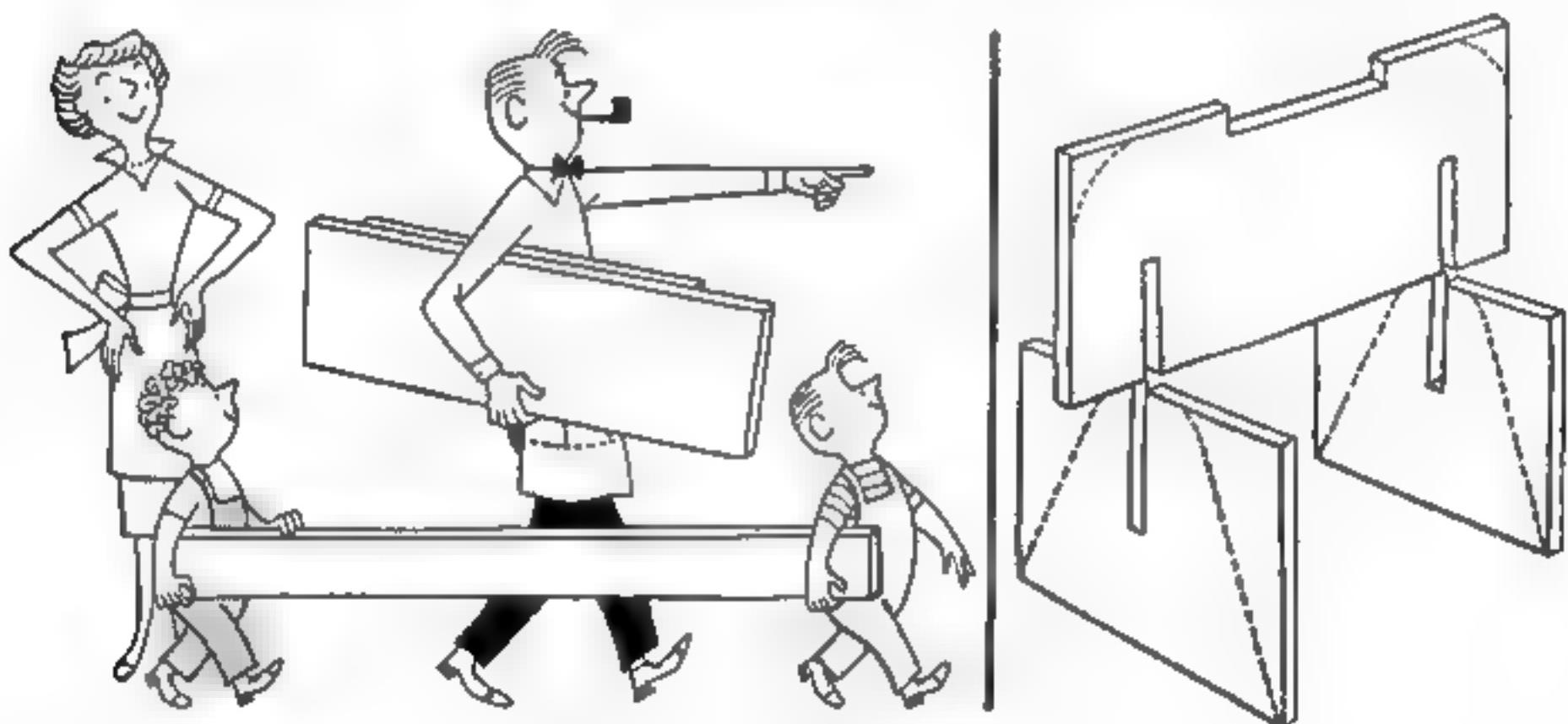
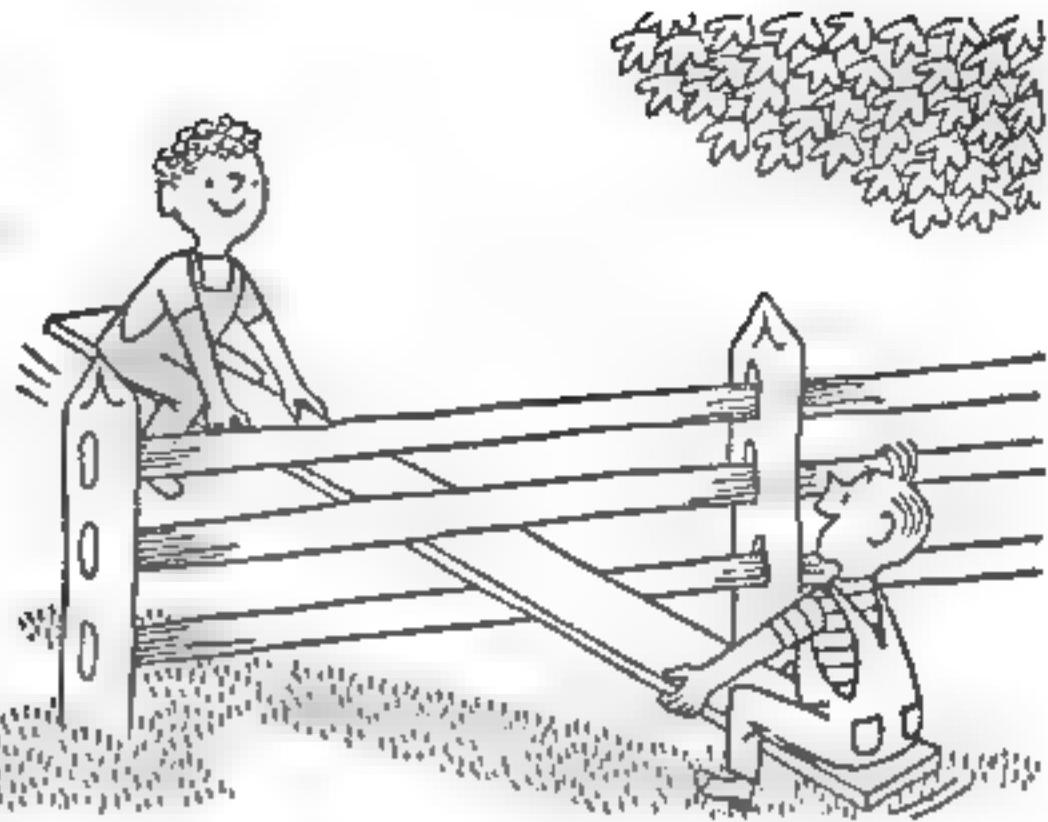
HOLLOW chrome piping and angle iron were welded together to make the frame for this portable picnic table and bench combination.

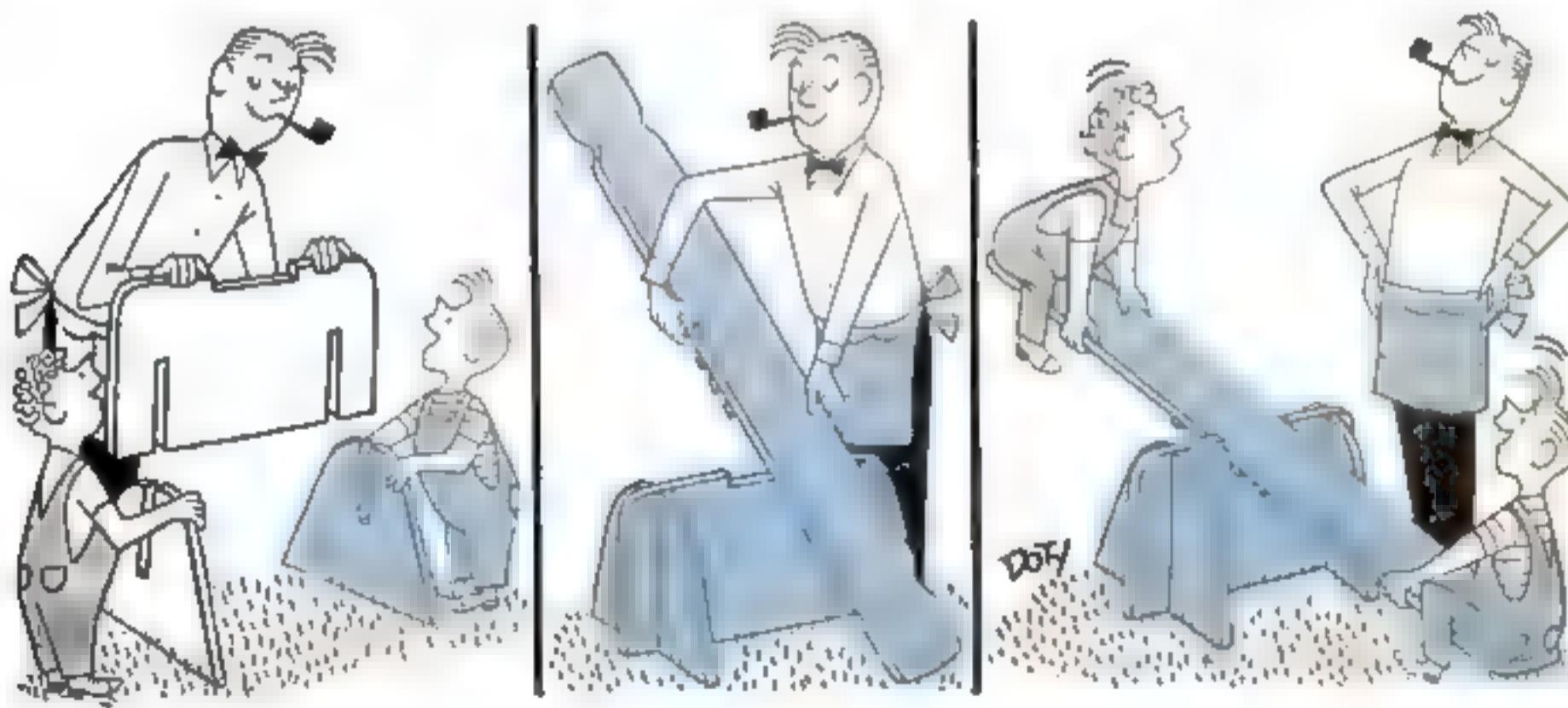
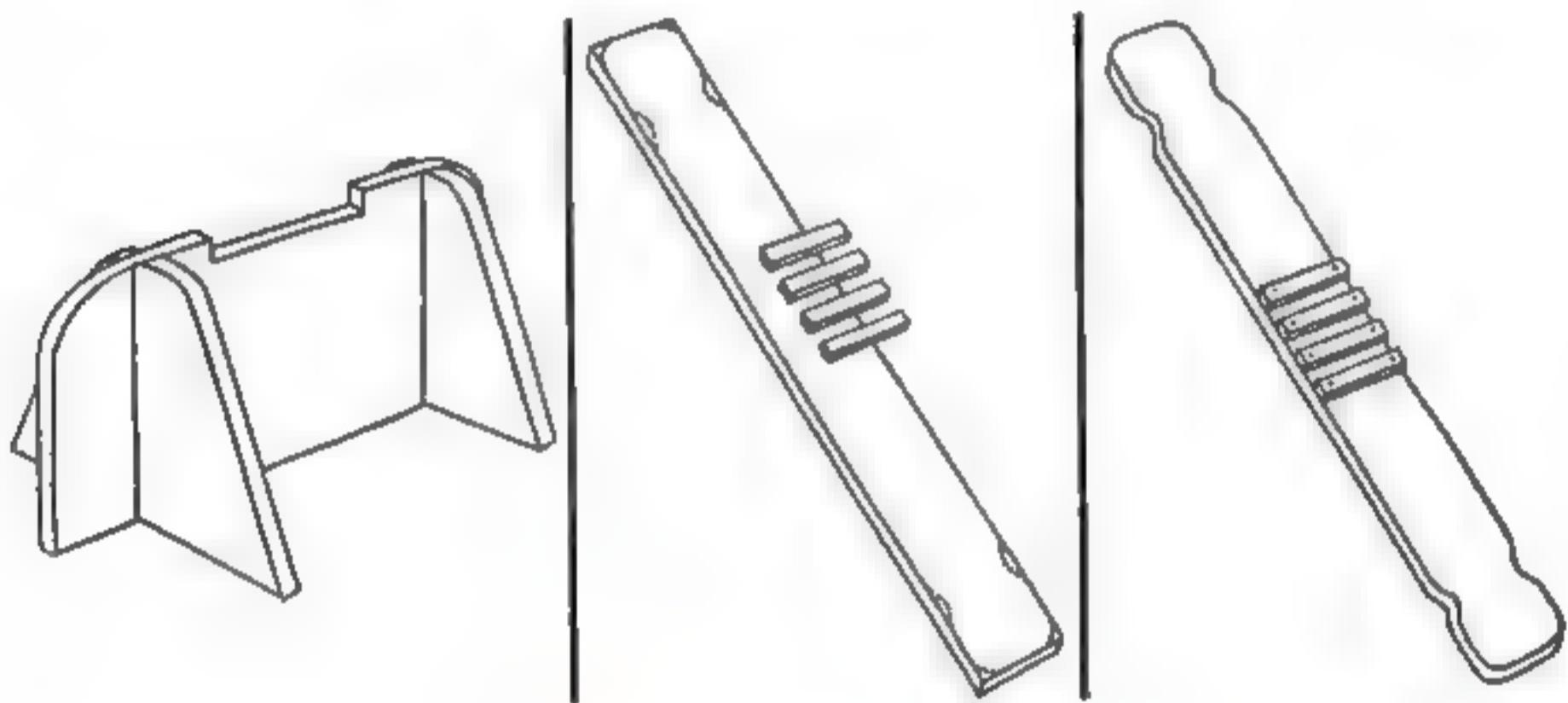
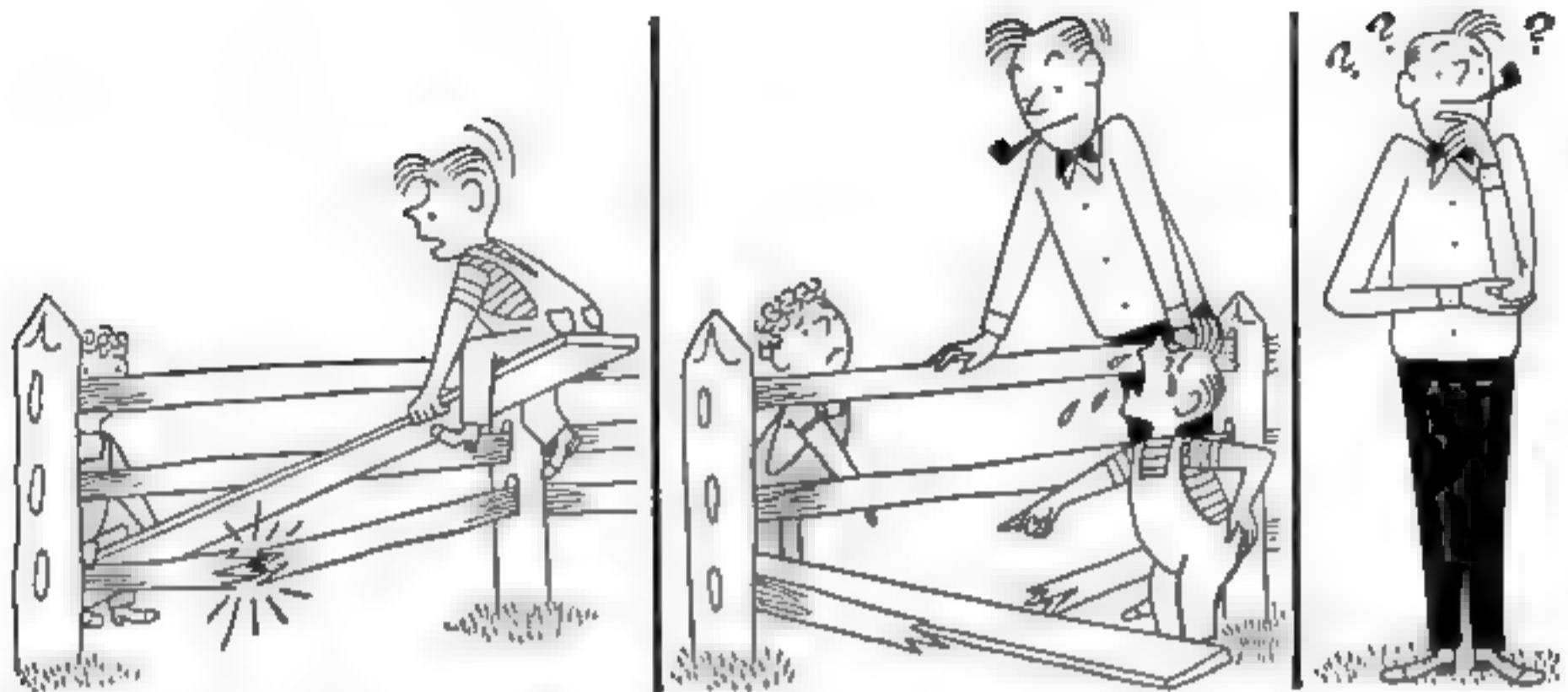
The wide wheels make it easy to trundle the table from one point to another. It was built by R. A. Burke, Brownstown, Ill.—*Grover Brinkman, Okawville, Ill.*



Wordless Workshop

By Roy Doty
and Charles E. Jackson





Extra Uses

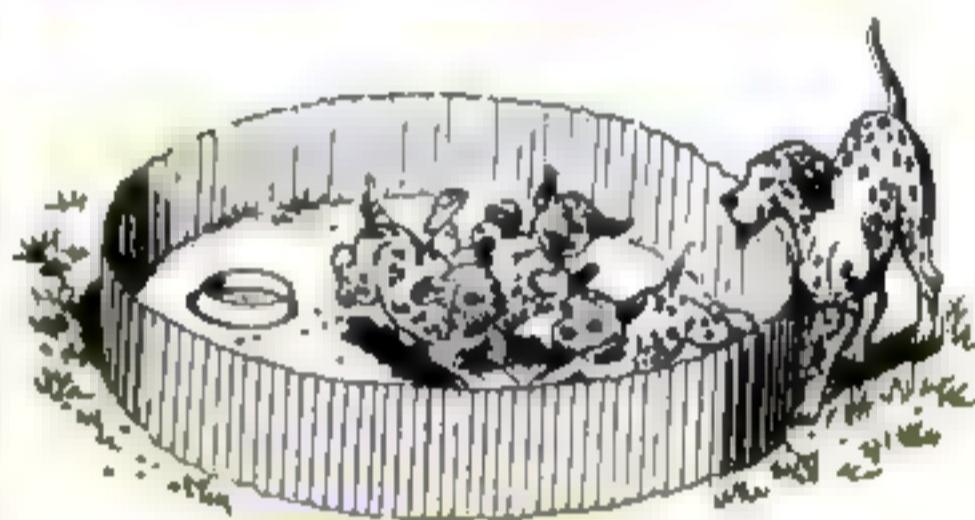


HANDY ROLLS of corrugated aluminum are easily cut to length with tin snips. They come 50' long in three widths—18", 30", and 54". Some dealers will sell you as much as you want by the foot.



GARDEN WALLS can be given decorative curves by using aluminum strips as concrete forms. Set two strips about 9" deep and 4" apart. Use two-by fours as spacers, removing them as you pour the concrete. The aluminum can be stripped off later and used over again.

SPARKS WON'T JUMP from this portable trash burner. It's rustproof and safe for small fires not hot enough to melt aluminum. Use an 18"-wide strip. Lap the ends and wire them together. Raise the bottom edge slightly on rocks if more draft is needed. A similar but larger aluminum cylinder also makes a fine garden compost bin.



PORTABLE PEN FOR PETS can be placed anywhere, then rolled up and stored when not in use. Use a 13' length for a 42" diameter, 18' for a 60" circle. Fasten the ends with sheet-metal screws or cord laced through holes.



for Corrugated Aluminum

By John Burroughs

CHANCES are you never realized what a handsome and versatile material corrugated-aluminum roofing can be—for purposes other than keeping the rain out. It's so strong, light, and flexible that it can be put to work in many surprising ways around a home.

At about 18½ cents a square foot, its cost is usually less than corrugated fiber-

glass, only pennies more than ordinary galvanized steel. And it has many special advantages: It comes in convenient rolls instead of unwieldy panels. You can cut it with tin snips. It's so light you can walk off with a full 50-foot roll over your shoulder. It doesn't need heavy framing.

The corrugations make the aluminum tough and springy, hard to dent. You can use it as is—the bright finish stays attractive for a long time—or paint it.



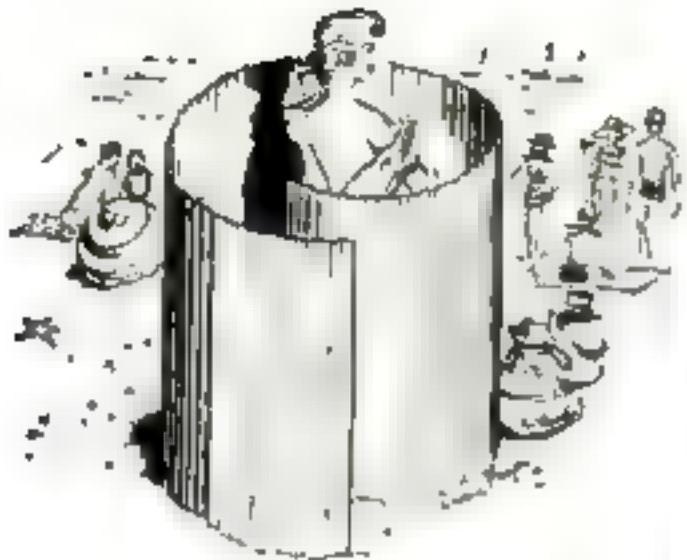
KICK PLATE protects doors battered by small feet and scratching pets. Tack a strip of 18" aluminum to the bottom of the door, flattening the ends and wrapping them around the edges of the door.



ALUMINUM AWNINGS can be made any size by fastening strip aluminum to a light wood frame. Use aluminum or stainless-steel screws or bolts to avoid rusting.

WANT BETTER PICTURES? You can get them with a light reflector made of aluminum tacked to a wood frame. It fills in harsh shadows and softens contrast; can also be used for bounce-lighting.





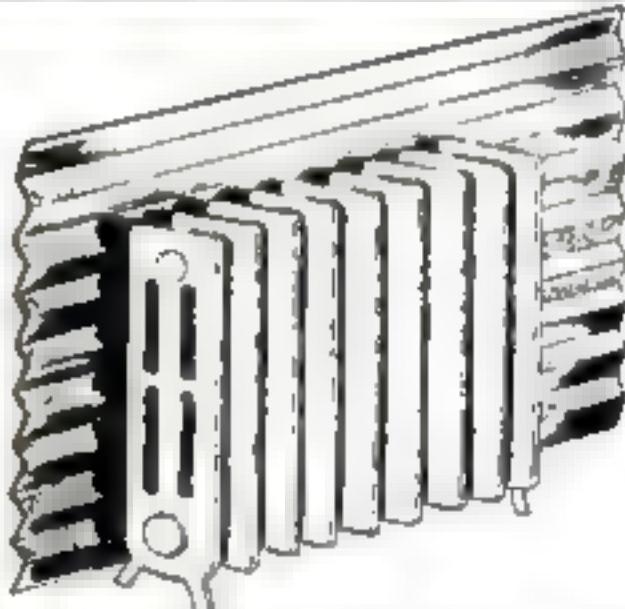
CARRY YOUR DRESSING ROOM with you when you go to the beach. It's simply a spiral of 54"-high aluminum. The overlapped ends form a door, yet give complete privacy.

CANOPY FOR A HOUSE TRAILER can be set up in minutes along the road. Aluminum strips, carried rolled up, are quickly unrolled and bolted to a knock-down frame. Frame rests on wrought-iron porch columns.



ALUMINUM CAN BE FRAMED to make screens and room dividers. Jigsaw wood strips to match corrugations and tack them on for a neat edge.

DECORATIVE FRONT for a counter or bar is easy with aluminum, especially around curves. It can be cemented on to avoid nailheads.



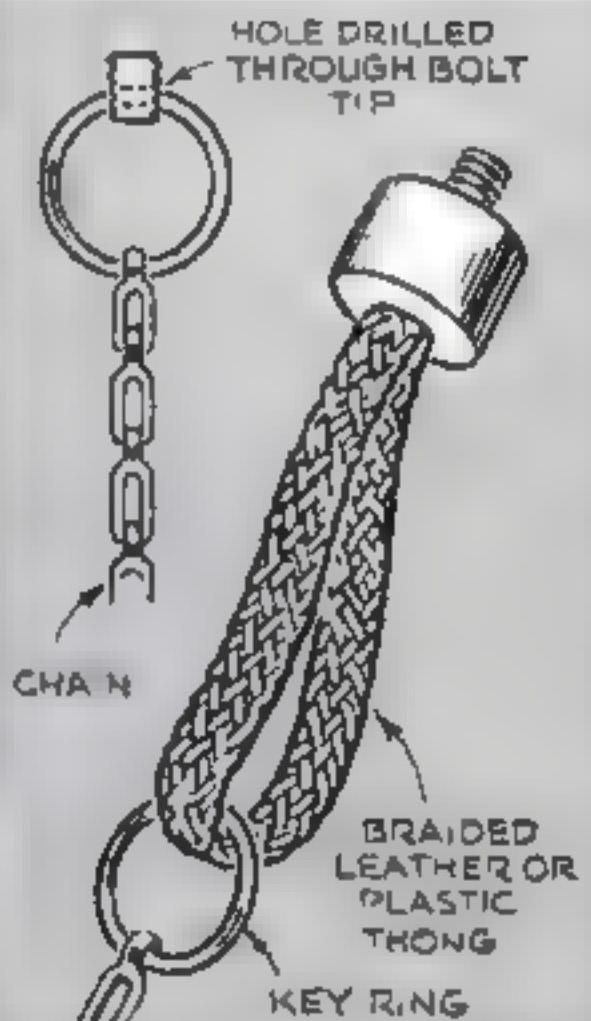
YOU'LL GET MORE WARMTH from a radiator if you fasten a strip of aluminum behind it to reflect radiant heat. It also protects the wall.

TO CARRY WATER AWAY from your house, slip a strip of aluminum under each downspout, cover it with sand, and bury it underground.





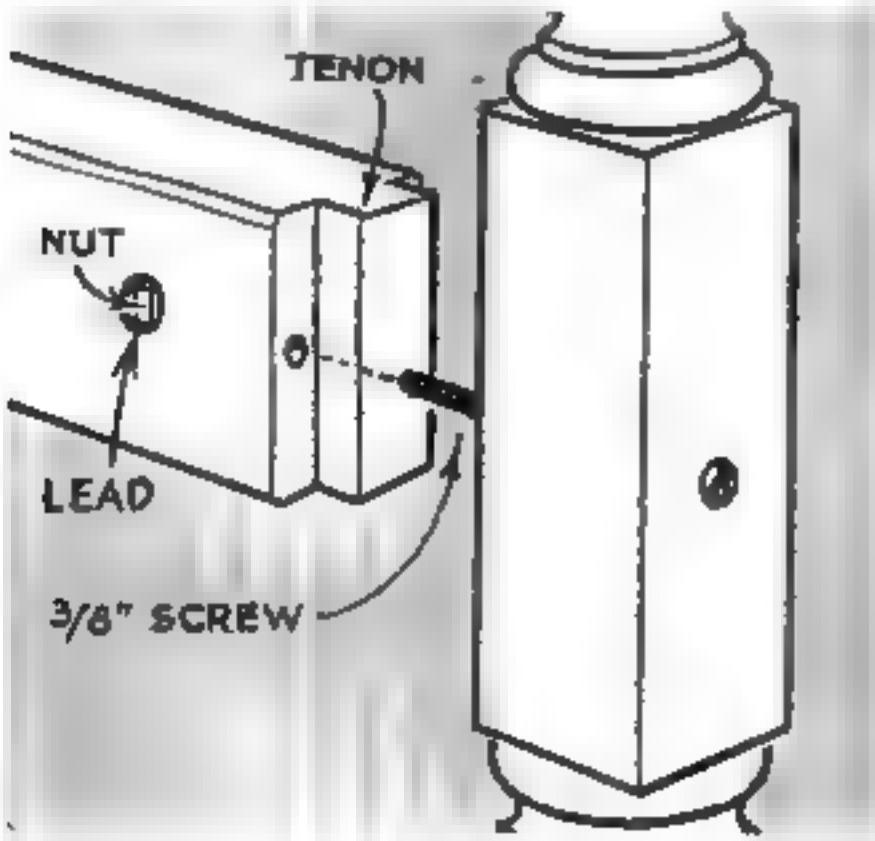
**Short Cuts
and Tips**
FROM PG READERS



Link Chain Sling for Tripod

A good camera steadier used by some professionals is a length of flat-link safety chain. You can carry it in your pocket, and it is particularly handy for quick shooting. Rapid changes of elevation or position are possible.

Fifty cents' worth of flat-link brass chain and a $\frac{1}{4}$ "-20 bolt are required.



Cut a short length from the threaded end of the bolt and drill a hole through it. Link the bolt to the chain with a small ring. Another way is to use a camera hand sling as the chain connection.

The chain can be employed for both standing and kneeling shots. Place one foot on the free end of the chain and elevate the camera so that the chain is taut.—Carlton G. Bucher, White Plains, N.Y.

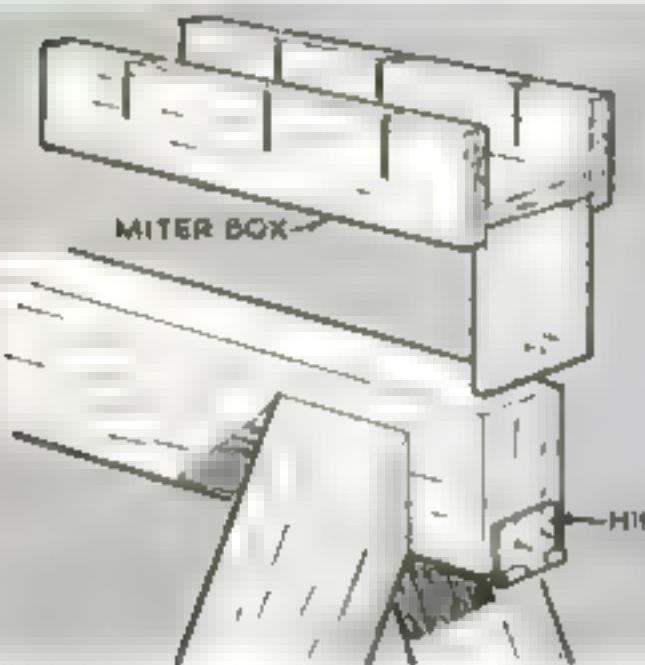
Lead Locks Bed-Bolt Nuts

So FAR as I know, no other person uses the method I have developed in my cabinet shop for bolting together four-poster and other antique wooden beds.

After a $\frac{1}{4}$ " hole is bored through the post and into the end of the rail for the $\frac{3}{8}$ " bolt, a larger hole is made in the inside face of the rail to put the nut on the bolt. With the bolt and nut in place, lead is poured into this second hole. When the bolt is turned out, the nut remains embedded in the lead. In the past the nut was often wedged in with wood shims, but these usually fell out, permitting the nut to loosen.—Dudley S. Currier, Newburyport, Mass.

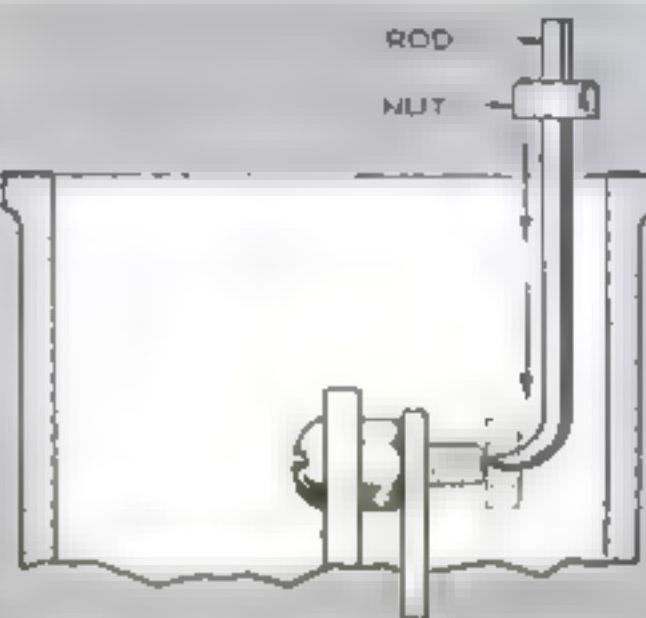
PS Favorite

Originally published in March and April, 1952, this article has brought so many inquiries that it is being rerun by popular request. If you remember any other old classics that you'd like to see again, we'd be pleased to have nominations.



Sawhorse Totes a Miter Box

BECAUSE I do a lot of carpentry around the house, I hinged a miter box to the end of a sawhorse so it's always with me. When not in use, the box swings neatly down and out of the way. The sides of the box extend down to fit over the horse's cross rail for extra sawing steadiness.—*Daniel Bousha, Jackson, Mich.*



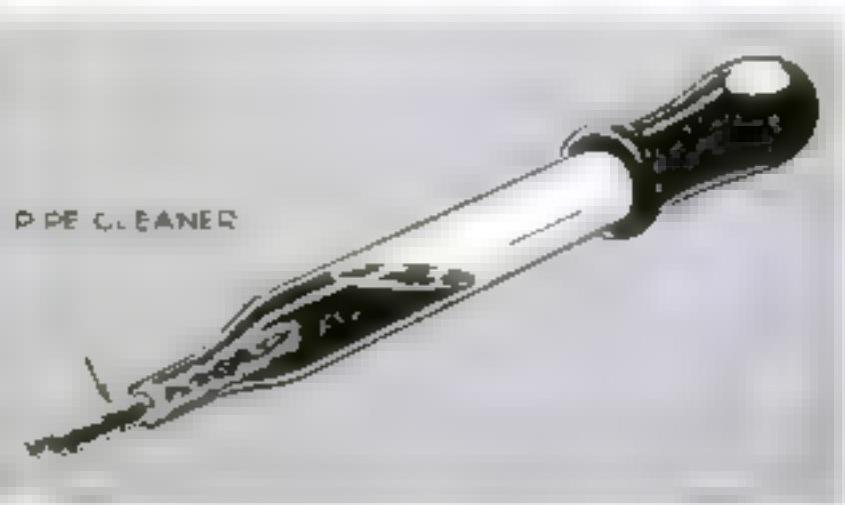
Starting Nuts in Tight Spots

WHEN you have to start a nut in an inaccessible place and don't dare drop it, try this. File a point on a stiff wire and curve the end. Place the point against the end of the bolt, then slide the nut down. The wire will hold the nut safely while you start turning it with one hand.—*Walter Hommel, Phoenix, Ariz.*



Jars Insulate Electric Fence

GLASS jars slipped over the tops of posts make handy insulators for electric fences. The fencing is easily wired to the ridges in the necks to hold it in place.—*Jack Dermid, Raleigh, N.C.*



Drawing Pen from Eye Dropper

AN EYE dropper with a length of pipe cleaner in the end makes a good lettering pen. Let the cleaner protrude $\frac{1}{4}$ " and dip it to start the flow of ink from the dropper.—*Clifford Schutjer, NYC.*



How Did the Arrow Get Through the Glass?

THIS eye-catching novelty will baffle your friends. It's an old trick, but there is no fakery about it. You can put a solid wooden arrow through any glass or bottle—through holes much smaller than the width of the arrowhead or end.

The arrow is a single piece, not cut apart and joined in any way. The photo is unretouched—the holes in the glass are actually as small as they look.

Can you figure out how it's done? Turn the page for photos of the solution.

You, Too, Can Shoot Arrows Through Glass

HERE'S the answer to the puzzler on the previous page. The secret lies in wood's ability to "remember." You can vise-squeeze it to half its original thickness. When you wet it, it springs back to shape. This arrow is pine, but almost any wood will do. The trick takes only a few minutes' work.



1 DRILL HOLES IN GLASS with brass tube and abrasive grit. V block steadies the drill.



2 CARVE ARROW and sand it smooth. Round the spear and shaft, but leave tail square.



3 SQUEEZE TAIL in vise until it is same diameter as shaft. Apply pressure slowly.



4 SLIP ARROW QUICKLY through holes in glass. Don't scrape wood on glass edges.



5 SOAK TAIL IN WATER to swell it to former shape. When dry, sand the raised grain.



By
Robert Gannon

This quick-starting basic fire will light bigger ones



Can You Build the Right Campfire?

You're no greenhorn if you know how to beat wind, rain, and freezing cold—and still come up with that hot meal

ONE glance at a campfire tells what kind of a camper its builder is—whether he carefully chooses the right type of fire to suit the job or just tosses together a pile of leaves and twigs, and hopes it will burn.

You can build many different kinds of campfires, depending on whether it's wet, dry, or windy and whether you want to keep warm all night or just heat up a quick can of beans. The fires shown here solve a variety of camping problems.

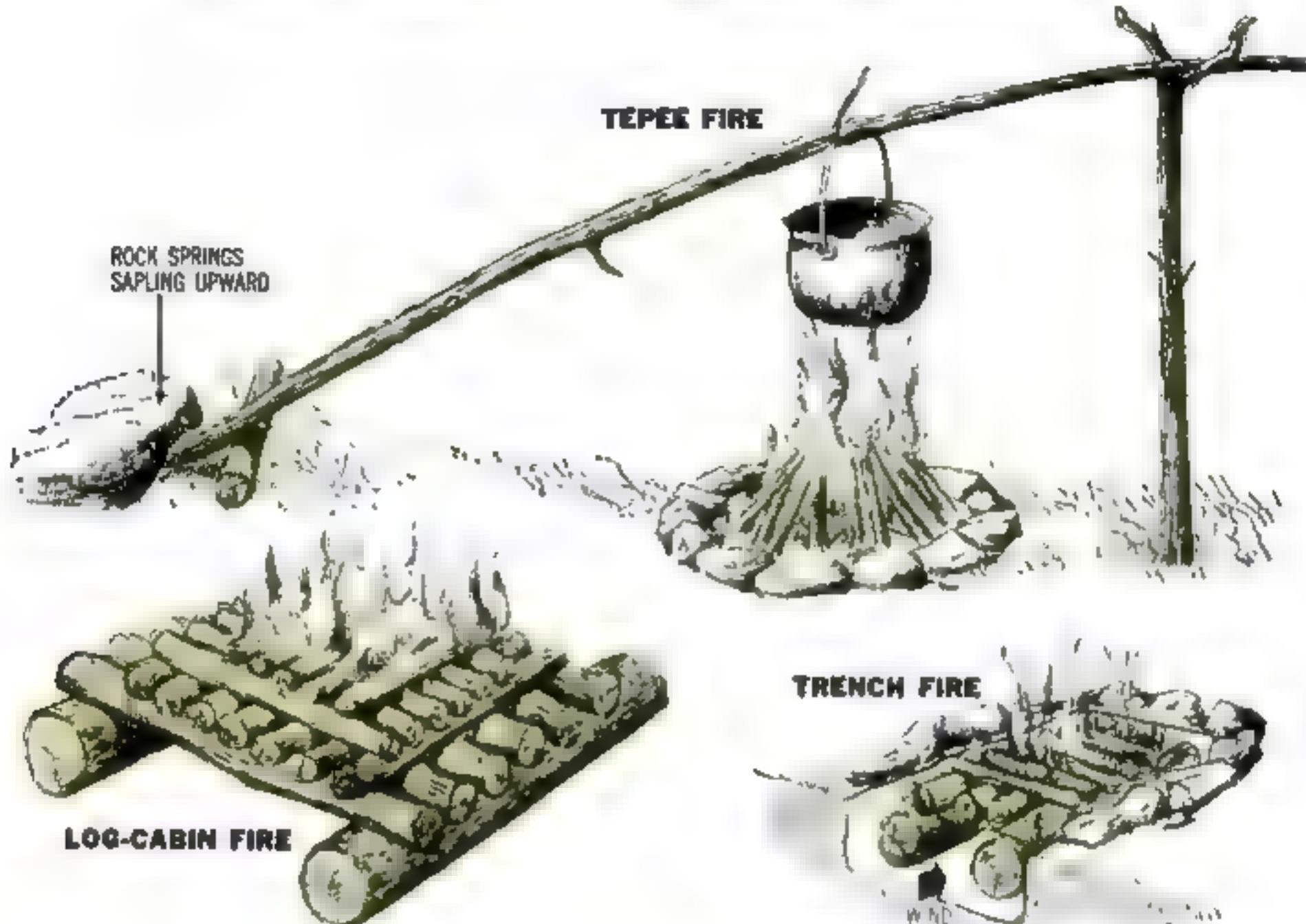
How to start any fire. All campfires begin with a basic foundation fire. Choose a dry, sheltered site free of leaves and underbrush. Start with a small pile of dry sticks for kindling. Don't use sticks lying flat on the ground as they are usually wet or rotten. Pick only those that break with a sharp snap.



If you have paper on hand, roll up an apple-size ball and place it on the kindling. If you're without paper, make three "prayer" sticks (also called "fuzz" sticks) as shown in the sketch on this page, and arrange them in a tripod.

With your back to the wind, arrange three sticks about 8" long and as thick as a broomstick in the form of an "A" on the ground around the kindling. Over the "A" build up a cone of sticks, starting with small twigs and gradually adding larger ones.

There's a right fire for every purpose. These six types solve



Touch off the paper or prayer sticks and, as the cone takes fire, blow lightly into the base. Keep adding sticks as the first ones burn away. When the cone is burning well, begin to turn it into one of the following fires.

Tepee fire for a quick snack. This is essentially the same as the basic founda-

tion fire, but built up taller by adding longer vertical sticks to the cone. The tepee concentrates intense heat at the peak and will boil water in a hurry, then burns quickly down to embers. It's perfect for a fast pot of coffee and a little noontime frying.

A forked stake driven into the ground

How to choose the best wood for your campfire

You don't always have a choice of woods, but when you do it pays to know which ones burn slow, fast, hot, or not at all. Pocket manuals are available to identify trees by their leaves and bark. It's a good idea to buy one and keep this list pasted inside.

In general, softwoods—spruce, cedar, pine—are good for starting fires. They burn quickly with high intensity, but leave poor coals. Hardwoods—maple, oak, hickory, ash—burn slowly and leave long-glowing coals.

Best fuel is hickory, green or dry. Next are oak, pecan, dogwood, apple, alder, and the ironwoods. Locust is one of the finest for all-night fires.

For slow fires, basswood, black ash, box

elder, tamarack, sycamore, buckeye, sourwood, and most poplars produce good coals. These burn only when dry, however.

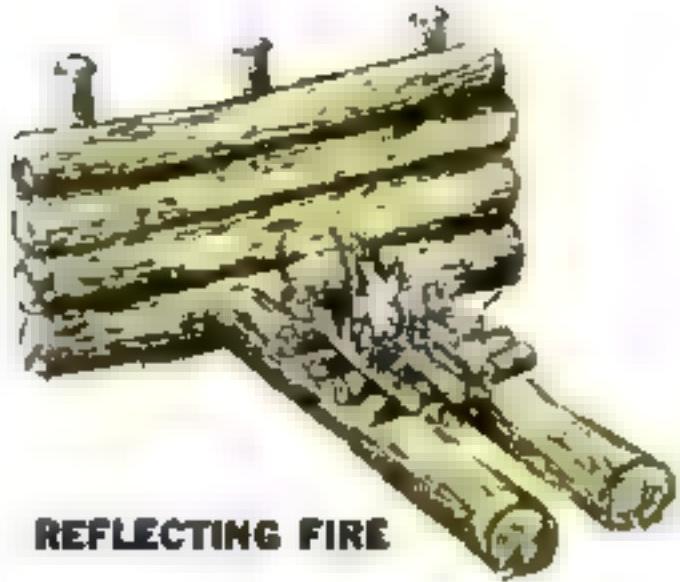
Good for kindling are the soft pines and birches. The pines, however, tend to spit sparks, as do beech, white oak, sugar maple, and balsam. Fires made of these woods should be carefully watched. Pitch pine, when dry, is the most inflammable of all woods. Yellow birch and white ash burn best when green, so don't use them as reflectors, near flame.

Chestnut and northern white cedar (*arborvitae*) produce dead coals. Yellow and scarlet oak, white elm, spruce, and cherry are also poor fuels. Driftwood along the sea is a fine fuel, but fresh-water driftwood is poor.

a variety of camping problems



INDIAN ALL-NIGHT FIRE



REFLECTING FIRE

WET-WEATHER FIRE

will hold a green sapling across the fire for cooking. For frying, find two flat rocks or a couple of logs to support your pan. A wire grate, from an oven or back-yard grill, is a handy extra and is easy to carry on a back pack. Shortly after the water boils, the tepee will dissolve into glowing embers—ideal for frying. The whole meal, from start to cleanup, takes less than half an hour and you can be on your way.

The leisurely dinnertime fire. This is the kind you need when you want to relax and take your time preparing the evening meal and also to ward off nighttime chill. It's called the "log-cabin" or crisscross fire. It's of no use while it's flaming—the idea here is to get a heap of long-burning coals.

Start with the basic cone fire and lay a good-size log 5" or 6" thick on each side of it. Across these logs build up rows of smaller logs, crisscrossed in log-cabin fashion, working toward a flat-topped pyramid as shown in the sketch.

Before closing in the top of the pyramid, light the foundation fire. Use two

forked sticks about 4' high to support a strong, green stick—called a "lug-pole"—across the fire. From this you can hang your pot hook ("waugan-stick").

Log-cabin fires are good for burning garbage, too. Use slow-burning cross sticks and lay drained garbage lightly on top, a little at a time.

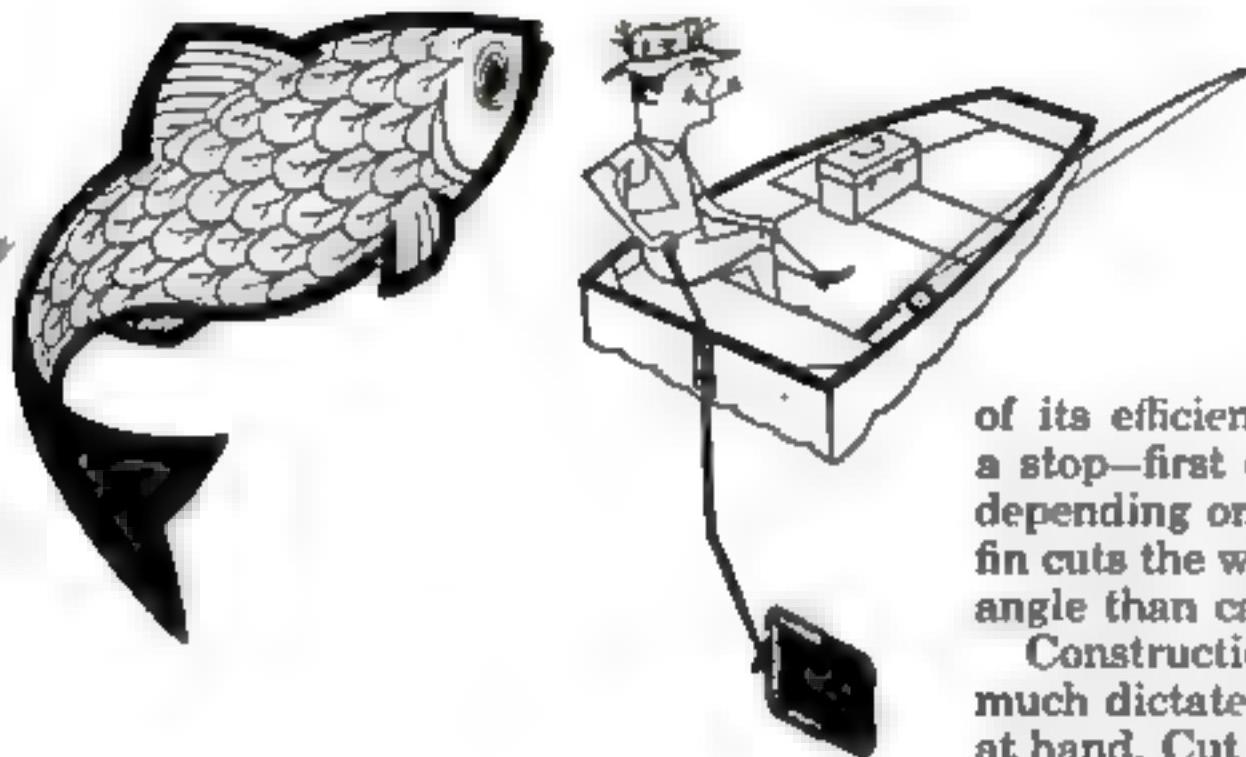
Dig in when the wind blows. During windy weather or dangerously dry spells, it's best to build your cooking fire in a trench. In line with the wind, dig a trench about a foot deep and wide at the windward end, and 6" at the other end. This shape provides a good draft. If possible, run it slightly uphill.

Line the sides with flat rocks. Lay rocks or green logs along the upper edges of the trench to support pots and pans. Build two small tepee fires in the trench. Over these construct a long, narrow log-cabin fire to provide cooking coals. A little chimney of moss or rocks at the downwind end of the trench will improve the draft.

Incidentally, when you remove a pot

[Continued on page 200]

The Boat That Swims Like a Fish



HAVE you ever envied the graceful ease with which a fish propels itself through the water? Here's how you can propel your small boat among the lily pads with the same tail-flipping action.

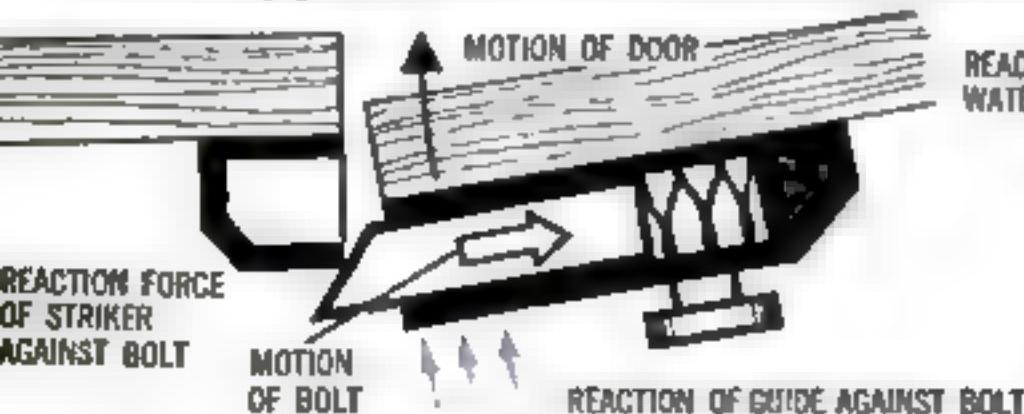
This modern improvement of the ancient sweep oar can be made in a few hours. It clamps on the transom of your rowboat just like an outboard motor. The "wrist" action of the fin is the secret

of its efficiency. As it flips over against a stop—first on one side, then the other, depending on the direction of sweep—the fin cuts the water at a more advantageous angle than can a rigid sweep oar.

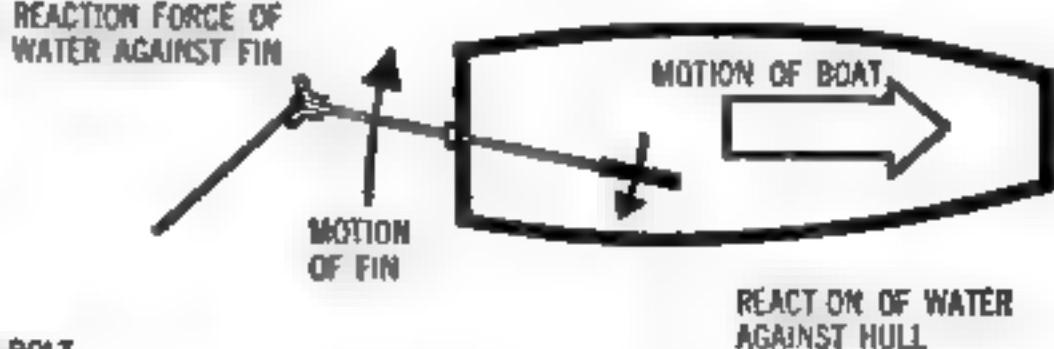
Construction details can be pretty much dictated by the materials you have at hand. Cut the fin to shape from heavy-gauge aluminum or steel and fit the $\frac{1}{4}$ -inch-steel-rod frame to it. Attach the rod with sheet-metal straps bent around the rod and riveted. A small U bracket welded to the frame makes the pivot. A bolt through this and a hole in the sweep arm joins the fin to the arm.

The mounting bracket can be as simple or as elaborate as you choose. For occasional use it might be a two-by-six block clamped to the transom, with two eyebolts or perhaps a short length of pipe used for the main sweep-shaft bearing. The aluminum bracket shown, with machined brass bearings, is made to last.

How flipping the fin forces the boat forward



ACTION OF DOOR LOCK illustrates why the fin pushes the boat ahead. Sideways push on angled face of bolt causes it to move in a direction perpendicular to its travel through space.

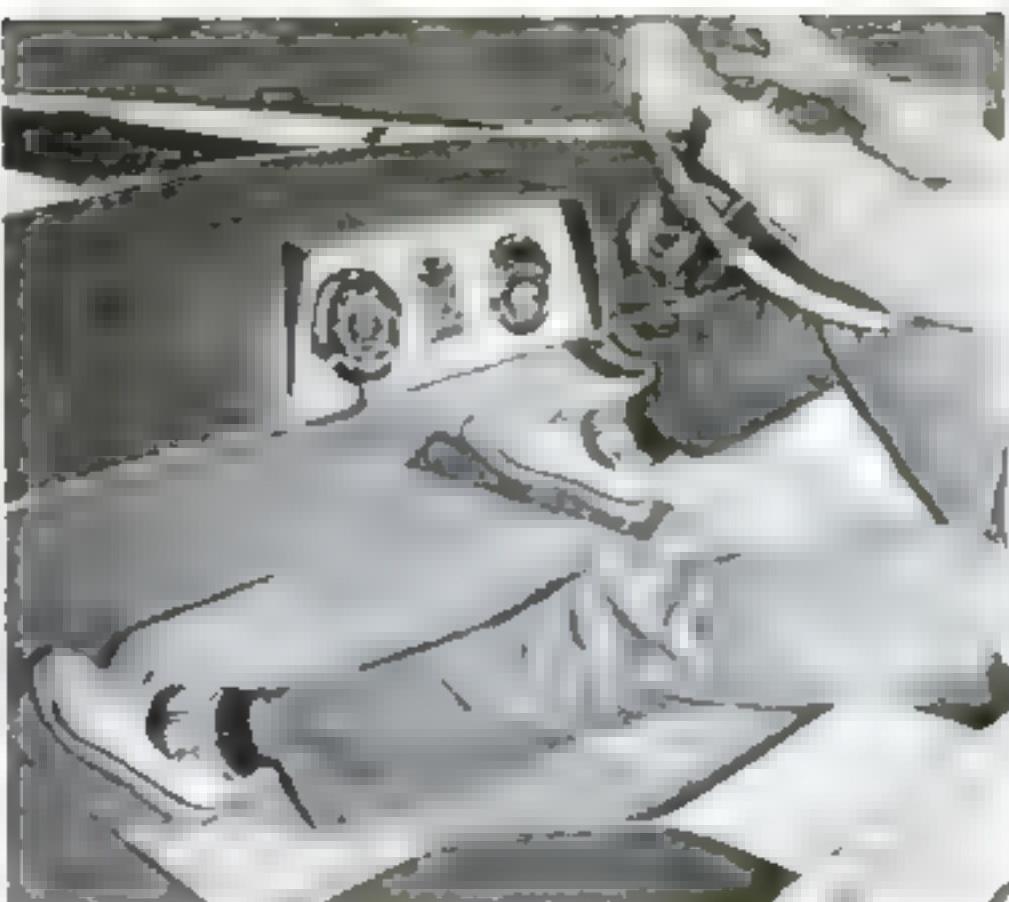


ACTION OF THE FIN is similar. As the fin sweeps sideways, the water acts like the striker plate on the door. Lateral resistance of the boat hull acts like the lock's bolt guide.

Better Footing for the Boatman

By V. Lee Oertle

STRIPS OF NONSKID TAPE pasted where your feet go, as at right, help you brace in rough weather. The tape, called Scotch-Tred, has a rough, slip-resistant surface and can be put to many uses around a boat, as shown below.



INEXPENSIVE STEP PADS can be cemented to a boat's gunwales without need for screw holes. The nonslip tape comes in handy rolls, is cut with scissors, has its own adhesive backing.

TRAILER FENDER gets rough wear from feet, is also dangerous to stand on. A strip of tape saves the paint—and your neck. Tape is just pressed on after backing strip is peeled off.

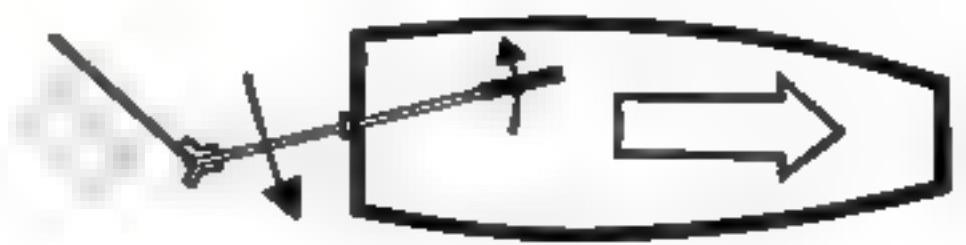
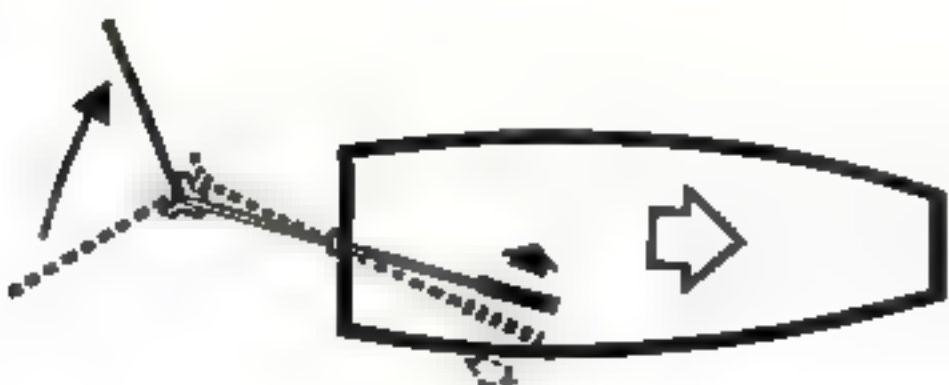
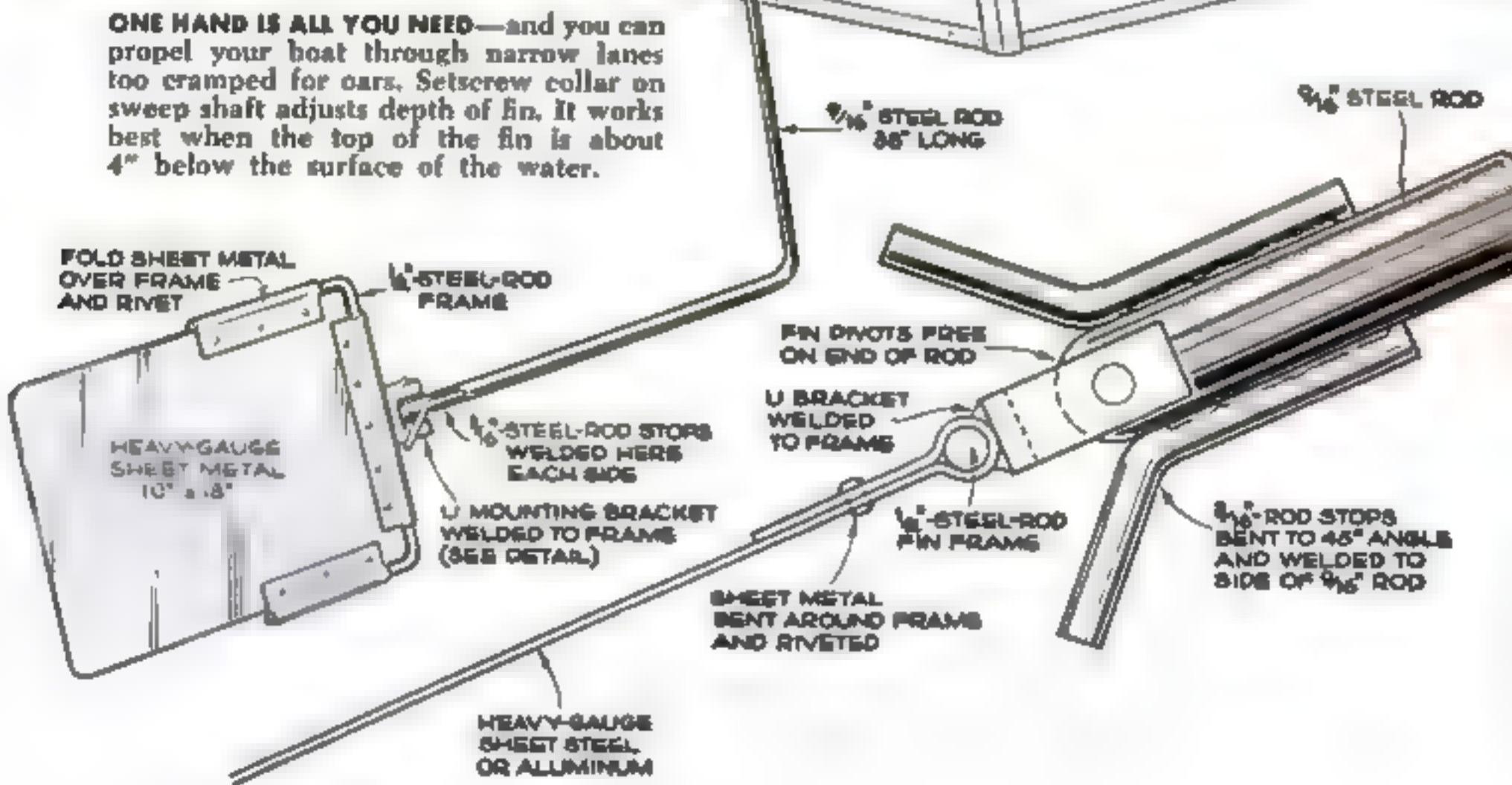


PROTECT A BOAT'S FINISH with strips of non-skid tape around the motor well and along other exposed edges. They'll prevent chafing from anchor lines, paddles, and other gear.

LAUNCHING IS EASIER if you paste a strip of tape along the tongue of a trailer. It will give you a footing to push the boat off when your feet won't hold on a wet, slimy shore.



ONE HAND IS ALL YOU NEED—and you can propel your boat through narrow lanes too cramped for oars. Setscrew collar on sweep shaft adjusts depth of fin. It works best when the top of the fin is about 4" below the surface of the water.



WHEN SWEEP IS REVERSED at the end of each stroke, the fin flips over automatically. The stop holds it at an appropriate angle to give a strong forward component to sideways motion.

ANY TENDENCY OF THE BOAT to move sideways as a result of the sweep in one direction is canceled on the return sweep. Steering is done by unbalancing the force and timing of strokes.

**know-how
file**

Helpful Hints on Doing Concrete Work

THERE is no easy way to do concrete work. But there are tricks to every trade—tricks that take the back-breaking strain out of a job and help insure its success.

Many of the 18 concrete-working tips that follow will fit a job you may be



planning. Some will save you time, others money. Nearly all of them will save your back. They're the result of careful job-planning by successful amateurs working alone or with minimum help on their own home jobs. Each has been tried and proven.

Work-saving tips for building forms

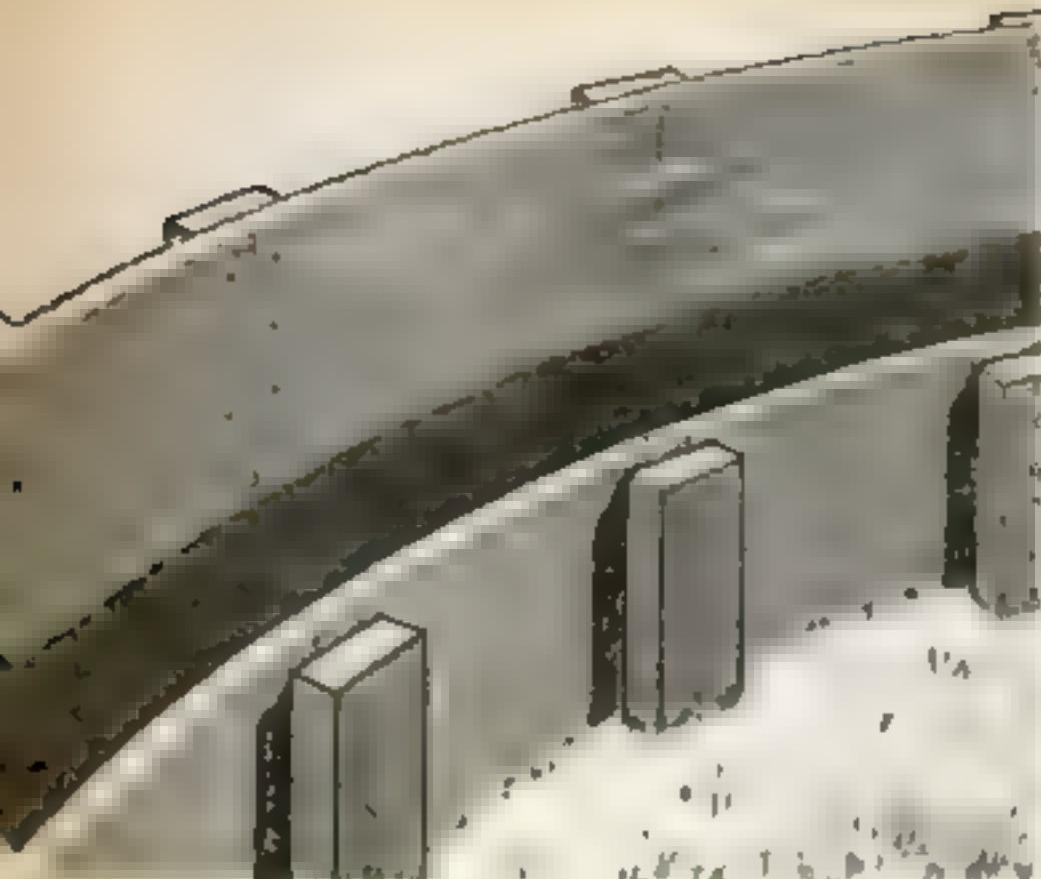
DIVIDE A BIG JOB into little ones about 4' square by building a permanent grid of rot-proof redwood. Varnish the wood to keep it stain-free. You can pour and finish each square easily before going on to the next.



AVOID WASTE by using good framing lumber for forms. Then clean and re-use it for construction. Four-by-eights shown formed a slab, later became ceiling joists. Plywood wall forms were later used for subflooring.



More tips on forms



TO FORM CURVES, score plywood on the back with saw kerfs spaced an inch or so apart. Nail the plywood (with the smooth side facing the concrete) to stakes driven into the ground. Place stakes at joints in the plywood form.



USE WATER PIPE as a center screed between widely spaced forms. This way you can pour and strike off half the slab at a time. Remove the pipe before the concrete sets and fill and smooth the shallow depression it leaves.

INSTEAD OF A CONTINUOUS WALK, cast steppingstones in a single reusable form that you move ahead as the walk progresses. If you want irregular shapes, you can shovel out 2" deep sharp-edged depressions and pour into them.



Making the mix



MIX CLOSE TO THE JOB, on a sidewalk or a concrete floor. Stir sand, gravel, and cement together while dry. Make a hollow in the center and pour in water gradually. Mix thoroughly with shovel.



MIX IN A WHEELBARROW when using prepared mix, or when a barrow load will do the job. Wherever you make the batch, hose and sweep the surface as soon as you're through, before the residue sets.

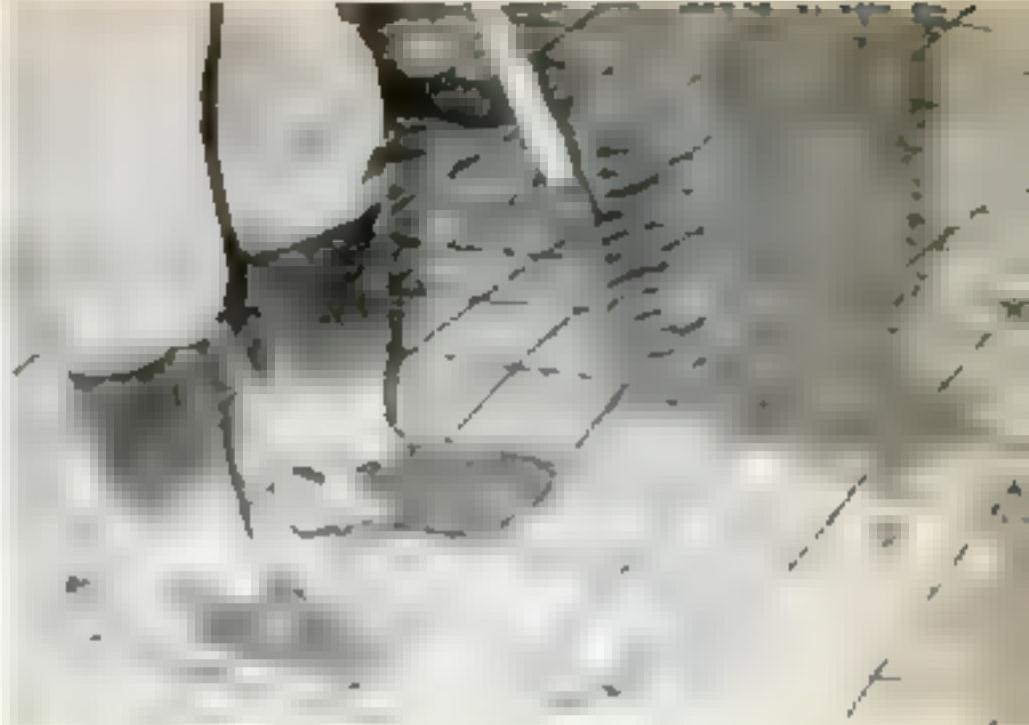
TO TEST YOUR MIX for the proper consistency, stroke your shovel over the pile when you think it's right. It should be dry enough to stand up well, yet smooth easily under the shovel as shown below.



Reinforcement adds strength, lets you reduce thickness



SAVE MATERIAL AND WORK by embedding welded-wire fabric in concrete. It protects against cracking, so you can reduce the slab thickness one-third to one-half. Bend it as shown for poured steps or other shapes.



LIFT THE WIRE so that it is about centered in the thickness of the slab. Do it as you pour so the cement can spread under it. A notch filed near the tip of your shovel can be used to catch and lift the wire to the required height as you work.

These tricks make troweling easier



QUICK-SMOOTH THE SURFACE: With a back-sawing, long-handled wood float, push down stones for easier finish troweling. No more than a board and a stick, it's worth making even if you discard it after a single job.

DON'T TROWEL until the water, brought up by the wood float, has disappeared from the surface. Premature troweling leads to a mottled surface that is likely to scratch, shed dust, and develop hairline cracks.

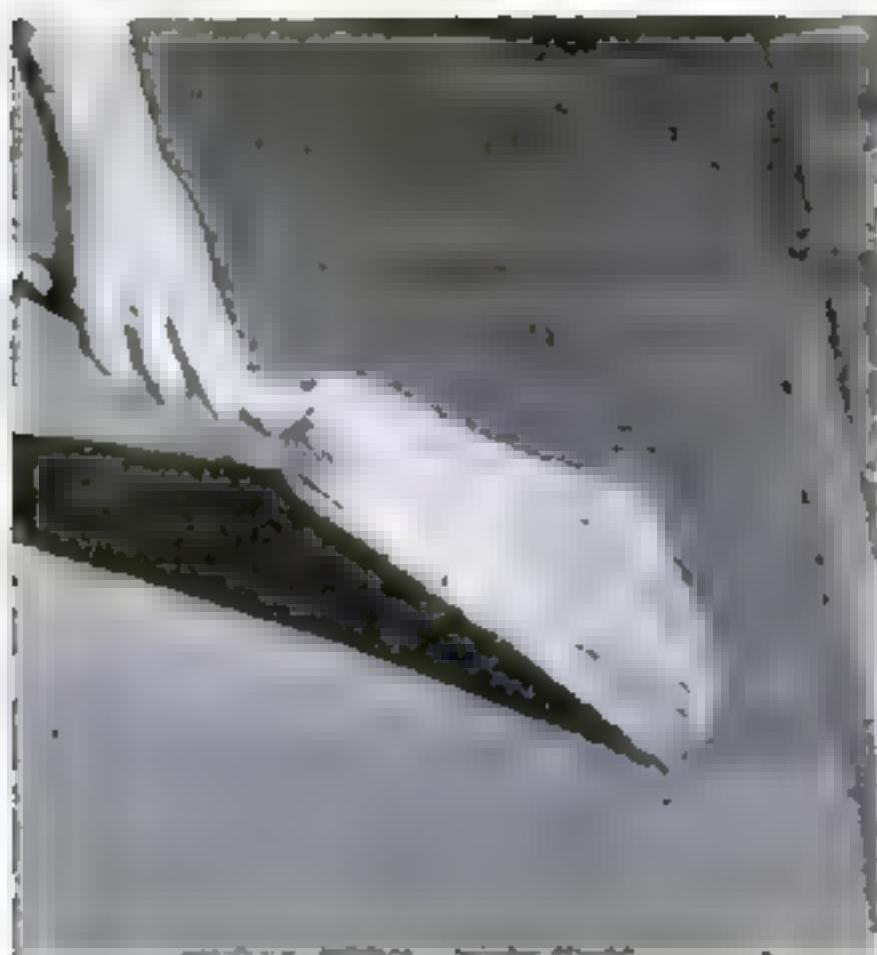


A BULL FLOAT, because of its great length, is useful for bringing the surface to a stone-free level. A pair of kneeling boards, with cleats for lifting, will support you on the wet surface as you work your way backwards.

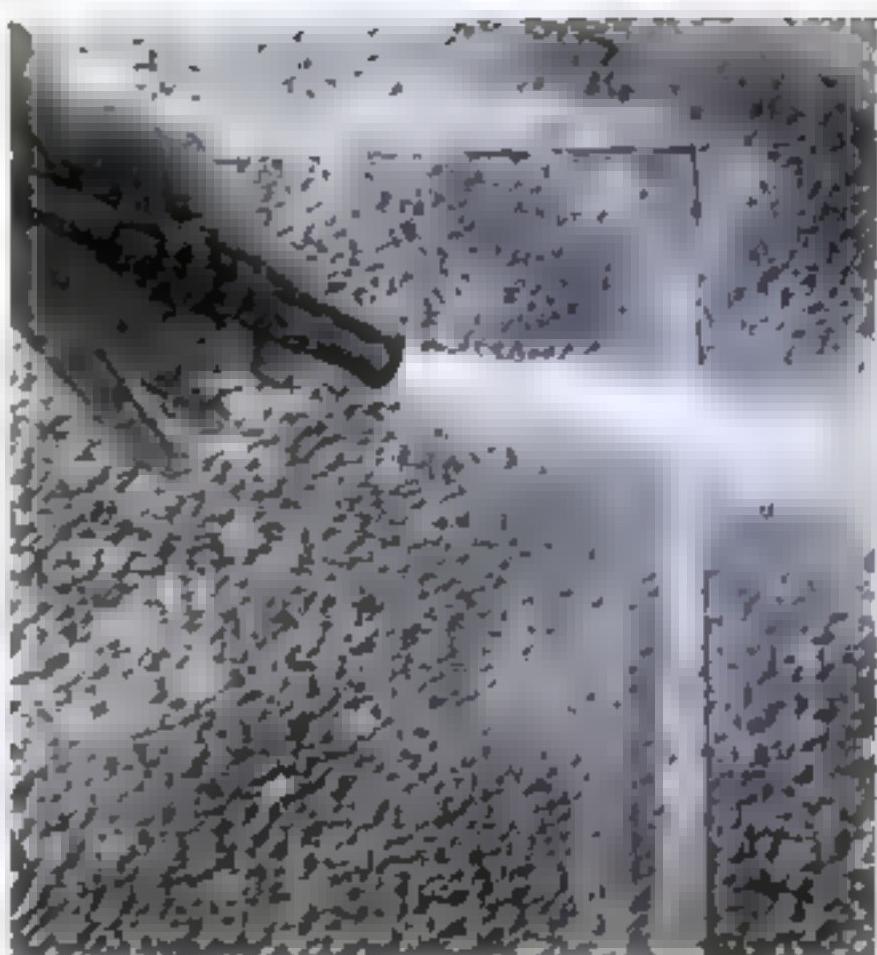
DRY-PACK THE CONCRETE on the inside of excavations for garden or swimming pools to eliminate forms and double-pours. Mix the concrete a bit drier than usual so that it can be laid on the slope without running down.



Simple surface finishes save work



A BROOM FINISH cuts out troweling, produces an attractive surface that's not slippery. Wood-float the surface; then, depending on the texture you want, stroke it with a straw or plastic kitchen broom.



PEBBLED SURFACE is called "exposed aggregate." Let concrete set a few minutes after leveling, then use the fine spray from a garden hose to wash away enough sand and cement to expose the top layer of pebbles.



IF YOU WANT COLOR, add it to wet concrete; paint or dye applied later won't stand up as well. After screeding, dust on a mix of sand, cement, and color. Work it in with a wood float and finish with a trowel.



CURE THE SLAB FOR A WEEK: You can dam the edges with sod and keep it flooded, as above, or cover it with sand, straw, or rags kept wet by sprinkling. Another way: Cover with plastic sheeting to keep in moisture.



How I Got Hooked by Kite Fishing

By George Daniels

BOX KITE is whipped into the air by Will Yolen, an expert kite fisherman. This size, available unassembled in toy stores, is popular with kite anglers because it will carry a fairly heavy fishing line.

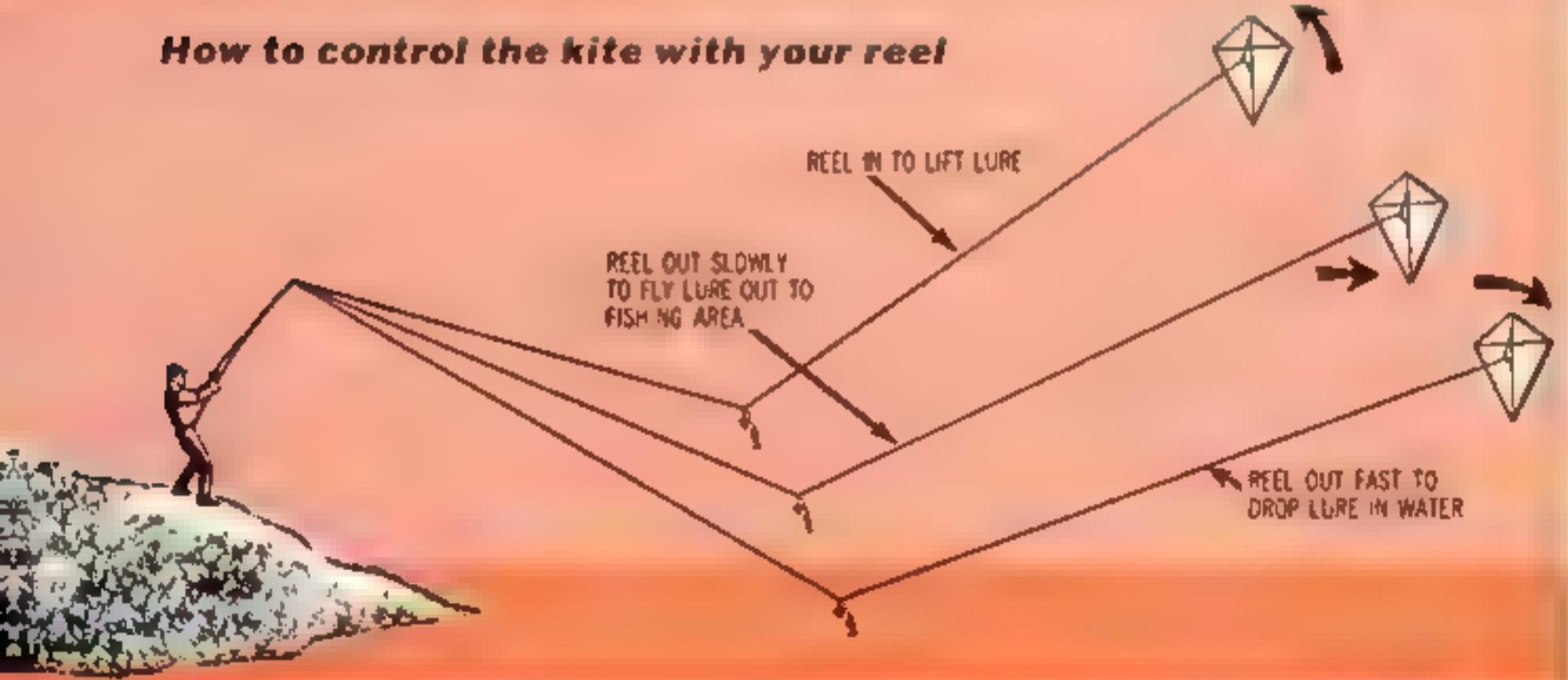
NOW I know how easily kite fishing can become a happy habit. You stand ashore along ocean, lake, or broad river and drop your bait way out where they're biting. You hook one. You reel in fast. The fish comes flapping to the tip of your rod while the kite soars smartly overhead ready for the next trip.

I learned about kite fishing from Will

Yolen, one of the sport's experts. On a visit to Compo Beach, on the Connecticut shore, we stayed right on land. Yet we fished from 100 feet to almost a quarter of a mile offshore, skip-fishing or trolling among rocks that no boat would dare approach.

I watched Yolen drop his lure within a yard of the splash made by a surfacing

How to control the kite with your reel



fish 250 feet away. I saw him bring in three- and four-pound blues then running in Long Island Sound—small potatoes indeed to the 40-pound stripers he landed with a kite off Truro on Cape Cod in 1957. But fine fishing nevertheless.

You need no special tackle for kite fishing—just a conventional rod, reel, line, and lures. The only extra you need is a kite, any kind, even the cheapest dime-store model. One with a fabric cover is best because you can soon dry it off if it hits the water. But that doesn't happen often.

Yolen carries his kite knocked down, sometimes wrapped around the rod. A minute or two assembles even the largest one. The assembled kite is then attached to the end of the line from the rod with a standard spinner swivel. If the breeze

is strong near the ground, Yolen launches the kite by yanking it into the air with the rod, reeling out slowly while gradually lowering the rod so he can back-whip it to give a quick lift if necessary.

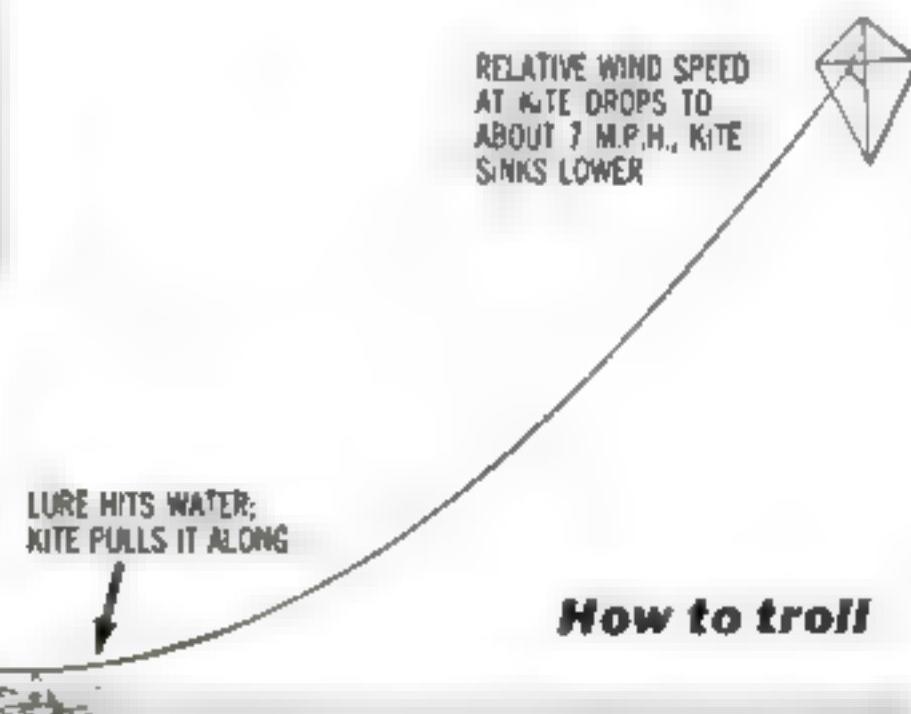
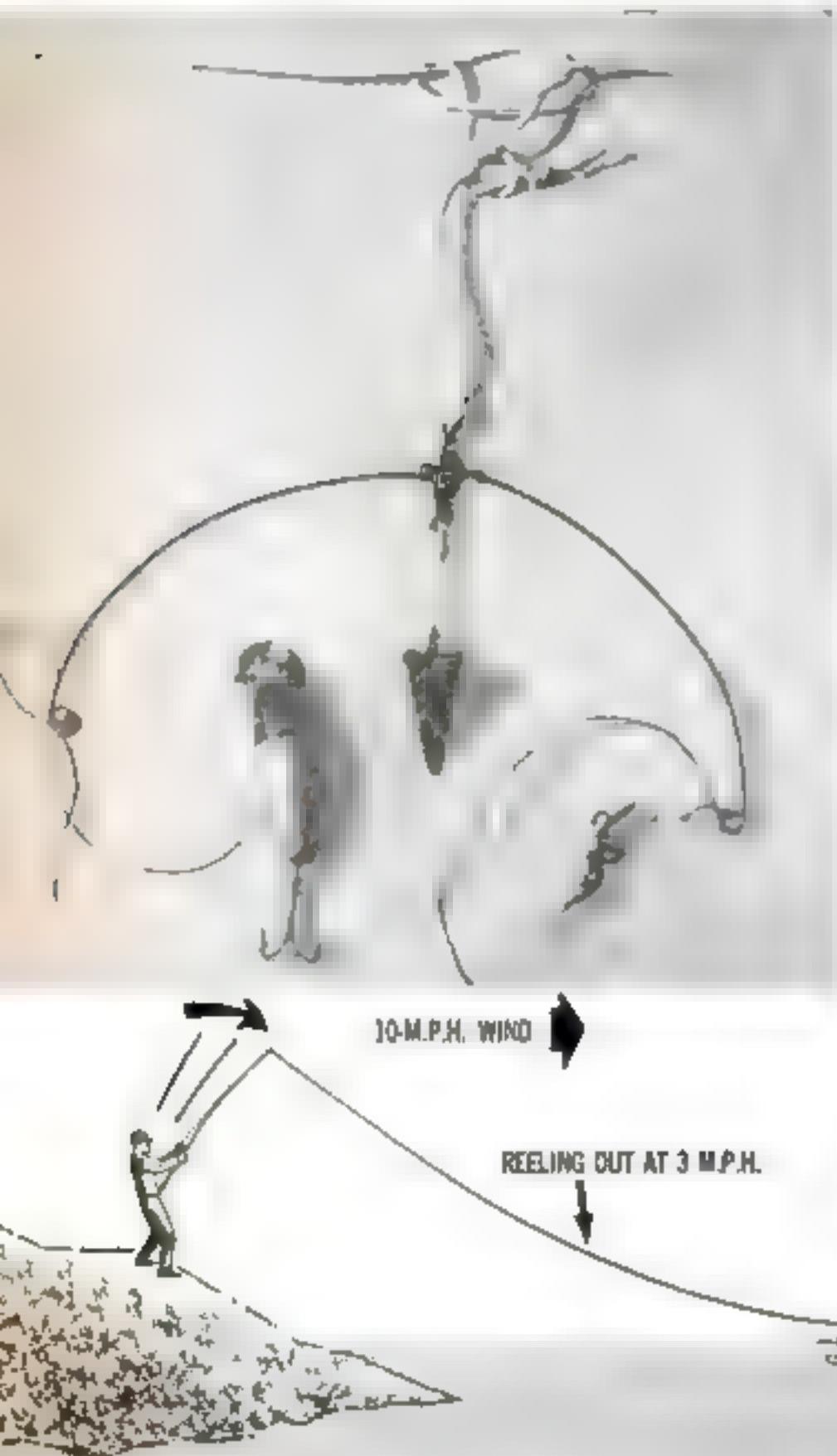
When trees or buildings block the breeze, Yolen uses a kite fisherman's trick of whirling the rod so its tip travels in a broad circle with the kite trailing while he pirouettes in a fixed spot. By paying out line as he turns, he raises the kite to the necessary altitude where the breeze will hold it up.

Attaching lure or bait. When the kite is in steady flight at the end of about 200 feet of line, Yolen locks the reel, holds the rod by the tip, and pulls in enough slack to permit tying in a leader that carries the lure and weight.

The right weight on the line is important. With too much weight the lure drops; with too little, it sails skyward and won't come down to the water even when you reel out fast. Add or subtract until the lure hovers a few feet over the water, with the kite stationary or as you reel out slowly. With this balance, you can skip-fish by controlling your reel or dance a fly on the surface by manipulating the rod. You can also fly the lure hundreds of

[Continued on page 202]

SPREADER WITH TWO LURES doubles chance of a bite, reduces weight needed. Knot illustrated can be looped into a continuous kite line even when the line is under considerable tension. Draw in line with one hand to produce slack while you form the knot with the other.





Columnist

Vertical Stretch - Squeeze The Columnist

By Art Margolis

You can fix most TV troubles simply by replacing tubes. Service records show that 85 to 90 percent of all service calls are for tube replacement. But locating the right one of 15 to 25 tubes can be a frustrating business unless you know which one to suspect.

Beginning this month, Art Margolis, a working TV repairman, will tell you some of his experiences in pinpointing such troubles. The first of this series deals with the tubes that affect vertical stretch and squeeze of the TV image.

"COME back and fix my TV right!" bellowed the voice on the phone. "Yessir, Mr. Crown, relax. I'll be right over," I assured him.

During the truck ride I reviewed my earlier call at the Crown Mirror Company. They had an old 12" TV installed in the rear of the shop. When I had turned it on, all that appeared on the screen was a white horizontal line—no vertical sweep.

Automatically I had turned the bright-

The most common vertical-sweep troubles will



COMPLETE LOSS OF VERTICAL SWEEP is indicated by a single white horizontal line across the center of the screen. Change the vertical-oscillator or vertical-output tube, or both.

ness control down till the white line disappeared. Ordinarily, the 525 lines spread over the full height of the screen. With no vertical sweep, all are drawn one on top of the other. Concentrated bombardment of one narrow strip can cause a burn mark across the face of the picture tube.

Next I had opened the back of the set and looked for the vertical-sweep tubes on the tube-location guide that is pasted inside. One is the vertical oscillator, the other the vertical-output amplifier. Failure of one of these two tubes is most often the reason for loss of vertical sweep. One look at the guide told me I wouldn't have to decide which to try first—both were in a single tube envelope, a double triode 12AX7. It was defective, for when I replaced it the picture spread out over the full height of the screen.

But the picture looked like an image in one of those fun-house mirrors. Heads were squashed flat, bodies were squat, legs long and gangling. Evidently the set had been out of adjustment before the tube failed. I reached for the vertical adjustments. There are two:

One is called "vertical linearity." When turned back and forth, it makes the top half of the picture expand and contract, accordion style. The other is named "vertical height" or just plain "height." It makes the bottom half of the picture stretch and squeeze.

I worked back and forth between these controls until the TV performers looked



INSUFFICIENT HEIGHT may be corrected with height and vertical-linearity controls. If not, and new vertical-oscillator and -output tubes don't help, try a low-voltage rectifier tube.

normal. Old man Crown wasn't there when I left, but I hadn't been in my shop an hour when he almost ruptured the diaphragm in my telephone.

Now I was back at Crown Mirror. I pulled up in front and went into the shop. I walked past Mr. Crown, glowering from his perch on the edge of a workbench, and turned on the TV. Picture and sound came in crisp and clear. I turned around to face Mr. Crown.

He barked, "You ruined my TV!"

I looked at the TV and frowned. "How's that, sir?" I asked.

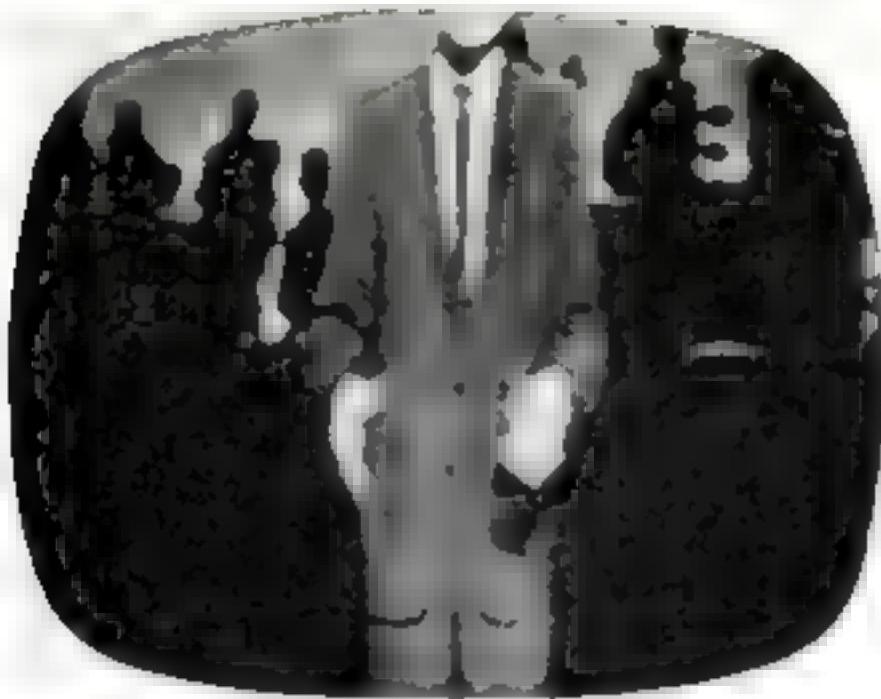
His face took on a helpless look. "Art, that distorted TV picture was the model for a mirror I'm making for Funland. Now that you've fixed it, I'm lost."

There's a first time for everything in this business. I spent the next half-hour getting just the right misadjustment of the vertical-sweep controls.

Ordinarily, though, few things annoy a viewer more than a TV that gives a pointed head, a lantern jaw, or pygmy legs to his favorite TV performer. These and similar distortions are all the result of vertical-sweep troubles. Fortunately, they are among the easiest for you to fix yourself.

First identify your vertical-sweep tubes on your tube-location guide. Typical vertical-oscillator tubes are: 6CM7, 6SN7, 7AU7, 7N7, 6CG7, 8CG7, 10DE7, 12AT7, 12AU7, 12AX7, 12BH7, 6BL7, 12SN7. Typical vertical-output tubes are: 5AQ5, 6AQ5, 6BX7, 6CG7, 6CM7, 6CZ5, 6DB5,

look like this on your television screen



TOO MUCH HEIGHT may be due to misadjusted vertical controls or gassy vertical tubes. If there is also loss of brightness, try horizontal-output and high-voltage rectifier tubes.

6U6, 6W6, 6K6, 12C5, 12CU5, 12W6, 13DE7.

Second, replace one or both of these, depending on what it takes to cure the trouble. Often they'll both be in the same envelope, so there is no choice.

Third step is to adjust the vertical controls if the people on TV are not in proper proportion. Eighty percent of the time your trouble will then be over. About 20 percent of the time it won't, and then your set needs bench work.

Simple as this sounds, sometimes you can get crossed up if you run into complications. Let me point out some vertical-tube-changing complications so you'll be prepared if you run into one.

The Crackerjack and the Broken Rule

I HAVE a motel account three blocks away that has about 50 TVs, all alike. The motel owner is a crackerjack of all trades. He saves a lot of money taking care of his own maintenance—even to tube-changing and adjusting the TVs. I keep him stocked with tubes that cover all the possibilities in his sets. I have coached him over a long period till he is a pretty good tube changer. However, even the best can get snared in a complication.

He called the other day: "Art, I have one that needs bench work. I'll bring it right in."

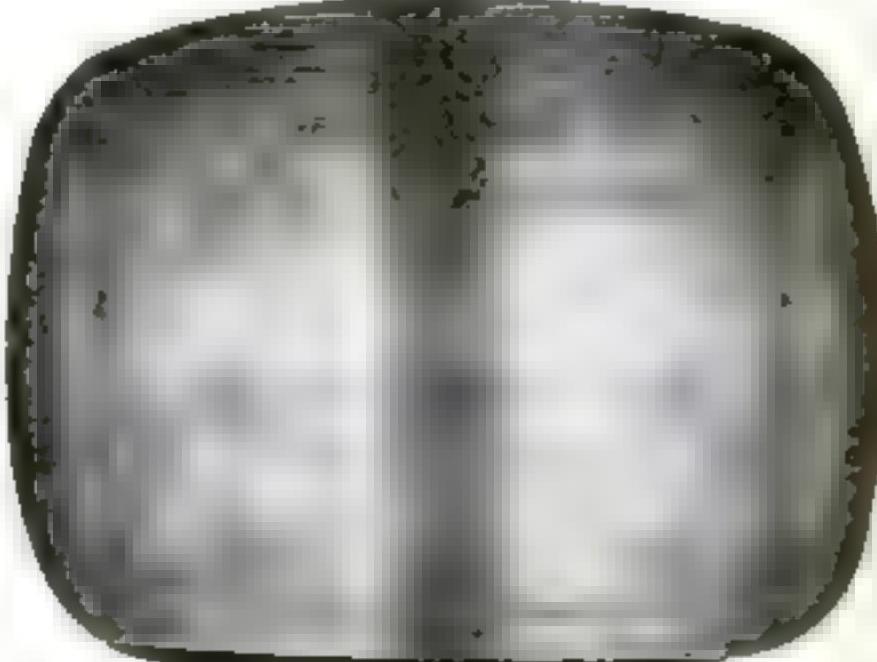
"Okay, Jay." I hung up and cleared a spot on the bench.



DISTORTION DUE TO STRETCHING in top part of the picture usually can be corrected with the vertical-linearity control. Height control will have to be readjusted to fill the screen.



STRETCH IN BOTTOM SECTION of the picture indicates misadjusted height control. Height and linearity controls interact somewhat, so you'll have to work back and forth between them.



BAD VERTICAL-OSCILLATOR TUBE can throw sweep completely off frequency. The picture will roll fast and no adjustment of vertical-hold control will hold it steady. Put in a new vertical-oscillator tube, then adjust the vertical-hold and vertical-height controls.

Two more symptoms that point to vertical-sweep troubles



PICTURE MAY ROLL SLOWLY, and look stretched, if there is too much vertical sweep. Adjust height control and vertical hold. If this doesn't fix it, replace the vertical-oscillator tube.



TWO SQUASHED PICTURES, one above the other, result from the vertical oscillator locking in at half frequency. If the hold control doesn't help, try inserting a new vertical-oscillator tube.

Soon Jay's hulking six-foot-six frame entered with a 21" TV under his arm. He eased it onto the bench and turned it on. The video came on first with no vertical sweep. Then lazily the pencil-thin line began to spread. Not bothering to pause when it reached the top and bottom edges, it stretched on beyond. Actors' heads rose to a point and the black spaces between the scan lines grew fatter. The bottom of the picture folded back on itself with a whitish overlay.

"I already replaced the vertical-output tube. That didn't fix it, so start digging into the chassis," ordered Jay.

A gassy vertical-output tube conducts too heavily, causing an overly vigorous vertical sweep. A new tube is the obvious

remedy for a set with these symptoms.

"Dig, man, I can't waste the day here. Dig," Jay said, impatiently.

But I noticed a secondary symptom. The picture was also shrunk in on the sides. I knew Jay wasn't going to be happy when I fixed this TV. He had given up too easily because of a complication.

Ninety percent of the time a new vertical-output tube is a sure cure when the symptoms are those I've described. But occasionally another tube, even one apparently unrelated, can cause the trouble.

In this TV, the vertical-output tube takes its grid bias from a junction between the horizontal-oscillator and the horizontal-output tubes. If either of these gets weak, the bias drops and the vertical-output tube runs away.

The tipoff here was the secondary symptom of horizontal shrinking.

Jay's jaw dropped when I replaced the horizontal-output tube and the vertical stretch and fold disappeared.

Triple Check Beats a Double Cross

MY KID cousin Pete got snagged on another vertical complication. He doesn't goof often, gets cocky in between times—and needs some deflation.

I had completed a tough dog, pushed it over to him to clean and adjust, and picked up the phone. Just as I was breaking the sad news of a bad picture tube to a customer, Pete blasted me with, "You did a rotten job on this one, Daddy-o."

I held up my hand to shush him while I coaxed the customer out of a state of shock.

"You goofed on this," Pete persisted.

I hung up and swung around. "What did you say, Pete?"

"This box has vertical foldover and it's not the vertical-output tube. I shall now delve into its inner recesses."

"Hold it," I snapped. "It's the vertical-output tube." I had taken bias readings that indicated a gassy tube.

"Watch," he snickered, and inserted the 12BH7 in the tube tester.

The needle rose into the "good" region. Then, to rub it in, he got a new 12BH7 and put it in the TV. Vertical foldover was still there but not quite so bad.

[Continued on page 204]



**Short Cuts
and Tips**
FROM OUR READERS



**Automatic
Picket Spacer**

IN BUILDING a picket fence, this easily made jig will space the pickets evenly and at the same height. Rest it on the top rail as you position and nail each picket.—*B. L. Wollenzien, Grand Junction, Colo.*



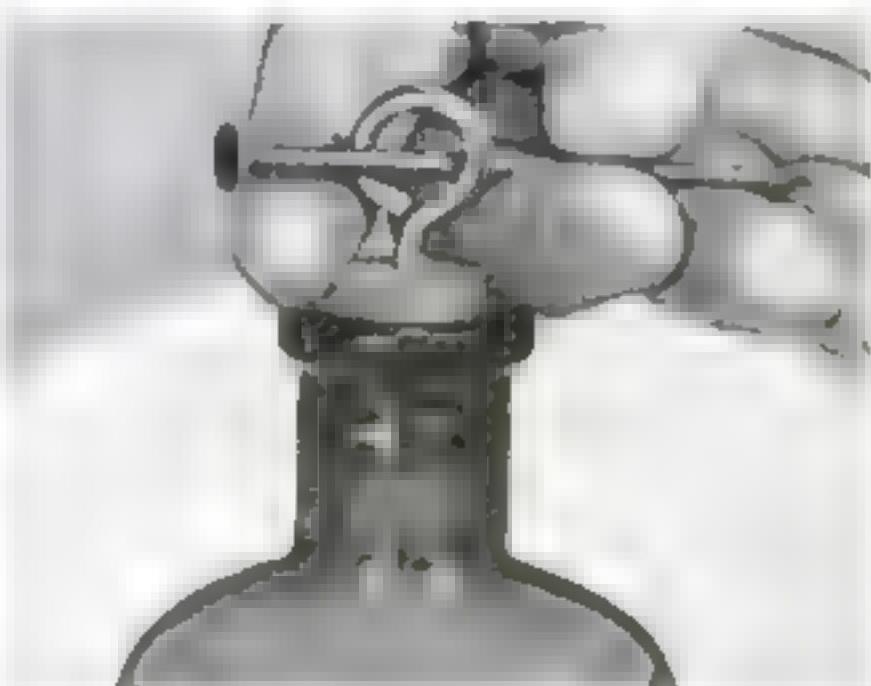
Brushing a Roller Clean

DON'T throw away an old and clogged paint roller. Give it a brisk scrubbing with a wire brush. This will fluff up the nap, make the roller look almost new.—*William Horrell, Louisville, Ky.*

Jig Holds Linoleum Block

WHILE being cut for printing, small linoleum blocks sometimes slip, damaging the design. This holder solves the problem. It consists of two pieces of quarter-round nailed to a piece of plywood to form a square corner. Always point the blade of the tool toward the corner.—*D. C. Honsowetz, Bath, Mich.*

►►►To POKE a curtain rod through the hem in a curtain without catching the material, place a thimble on the rod's end.—*K. C. Cathey, Stillwater, Minn.*



Substitute for a Corkscrew

WHEN you can't find a corkscrew to open a corked bottle, here's what to do: Turn a large screw-eye into the cork and use a nail for a grip to pull it out.—*Bill Toman, Palatine, Ill.*



Short Cuts and Tips

FROM OUR READERS



Keyhole Saw from Broken Blade

A BROKEN hacksaw blade can be turned into a fine-pointed keyhole saw for getting into small holes. Grind the back edge of the broken end down to a taper. Slip the other end into a slotted wood dowel for a handle and wrap it with wire. You get a bonus, too—when the teeth are worn down, grind a cutting edge on the blade and you have a sharp knife.—*W. Ellerington, Barrhead, Alberta.*



Hand Grips for Cartons

EVEN heavily loaded cardboard cartons won't slip out of your grasp—and can be toted with less strain—if you take a minute to cut carrying handholds.

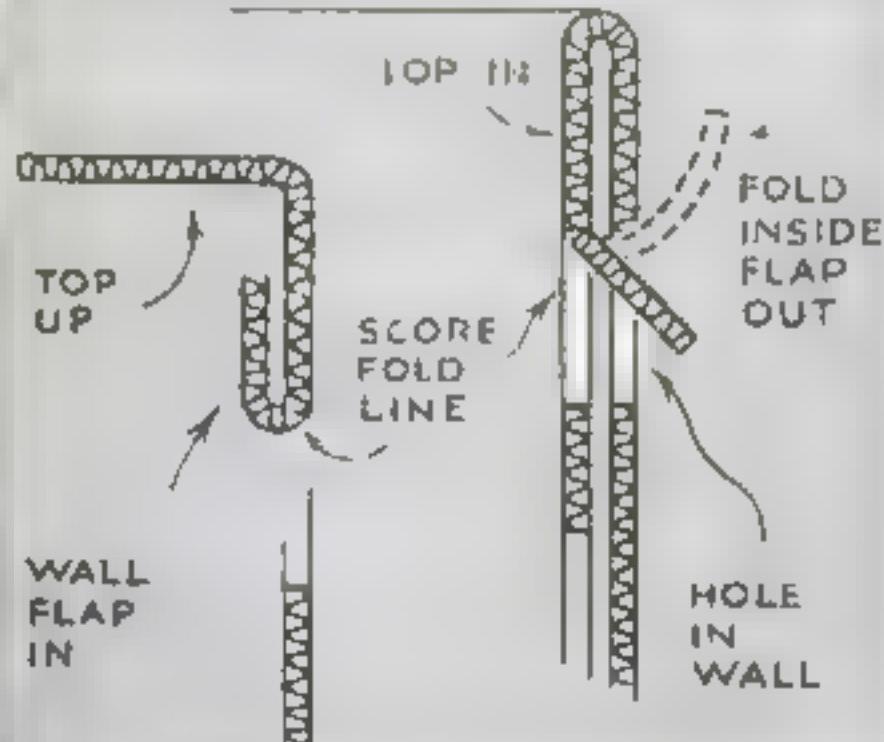
With the carton empty, make a U-shaped cut in opposite sides. The bottom of the U should be 4" long and the upturned sides $1\frac{1}{2}$ ". If the top is to be closed, turn the cut flap inward. If it's



Dog's Life a Fine One

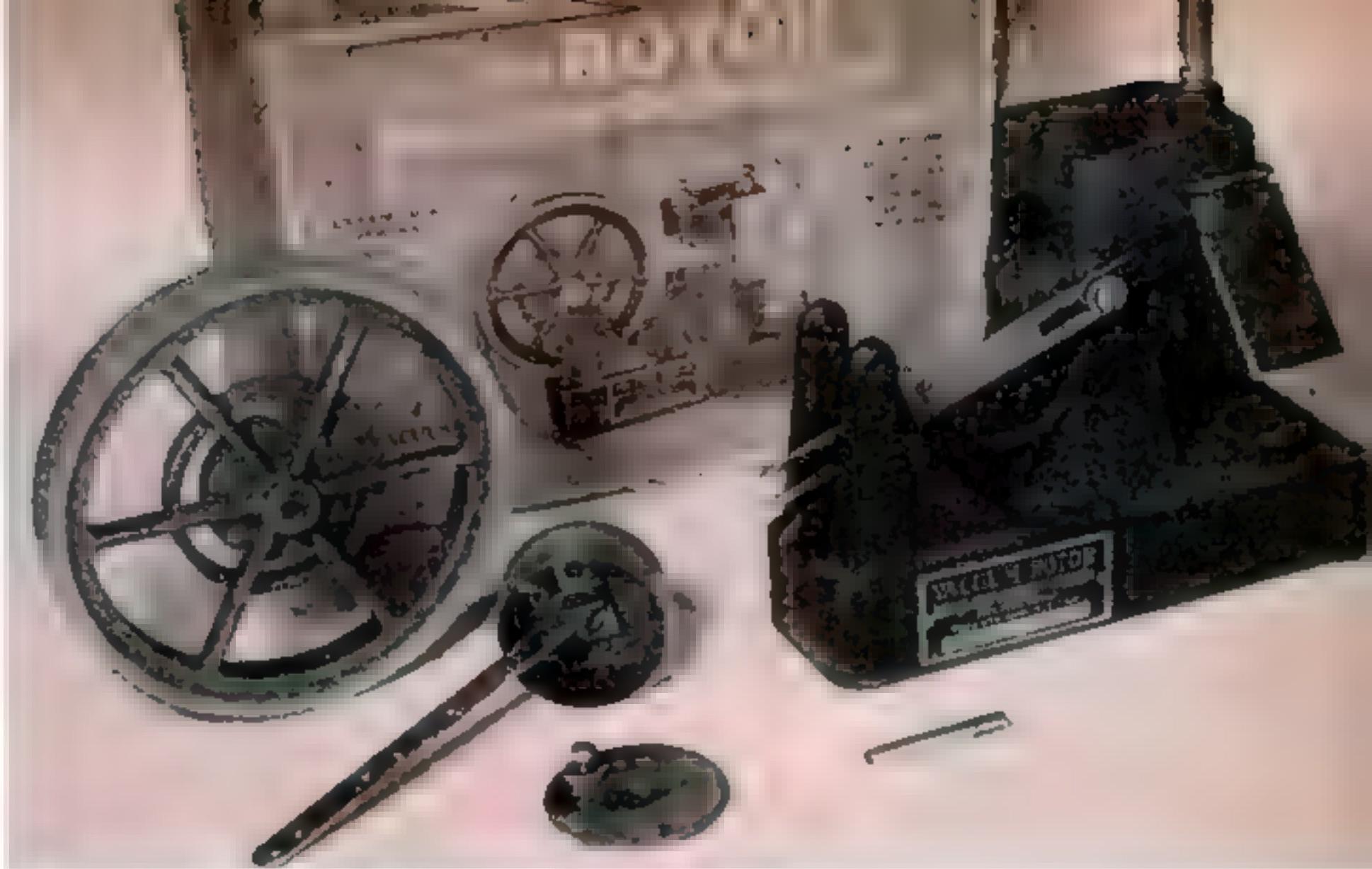
OTHER home owners with a pet-parking problem may find a solution in a bunk like the one we built for Red, our 45-lb., 10-year-old Malamute.

Recessed into a clothes closet, it is 34" long, 18" high, and 18" deep. A strip of metal mesh at the top of the back wall gives ventilation. A foam-rubber bed with a plastic cover is easy to keep clean.—*George A. Healy, Hemet, Calif.*



to be left open, cut a rectangular hole in the wall. With this as a guide, cut a flap in the folded-down top panel. Fold the flap out as shown.—*Harry Walton.*

►►► You can save unconsumed charcoal briquets for another barbecue fire by shoveling them into a can with a tight-fitting top. Without oxygen, the coals soon cool and are ready for use next time.—*D. Emilien Perrin, Metairie, La.*



"The Rotor, Successor to the Motor"—that's how the makers billed it in the Twenties. The author got it as junk, but the case wasn't hopeless

Adventures with an Old-Time Engine

By Harry Walton

IT'S amazing how much you can learn from a 40-year-old engine. And the fun you can have with it.

I'm one of those characters you see staring goggle-eyed with envy at all the magnificent old engines in the Smithsonian. But now I have an old-timer, too—a vacuum engine, a cranky little machine even in its brief heyday. I bought it as a piece of junk.

My struggles with that engine taught me a few things, knocked the cockiness out of my self-esteem, and along with some wry moments gave me hours of fun.

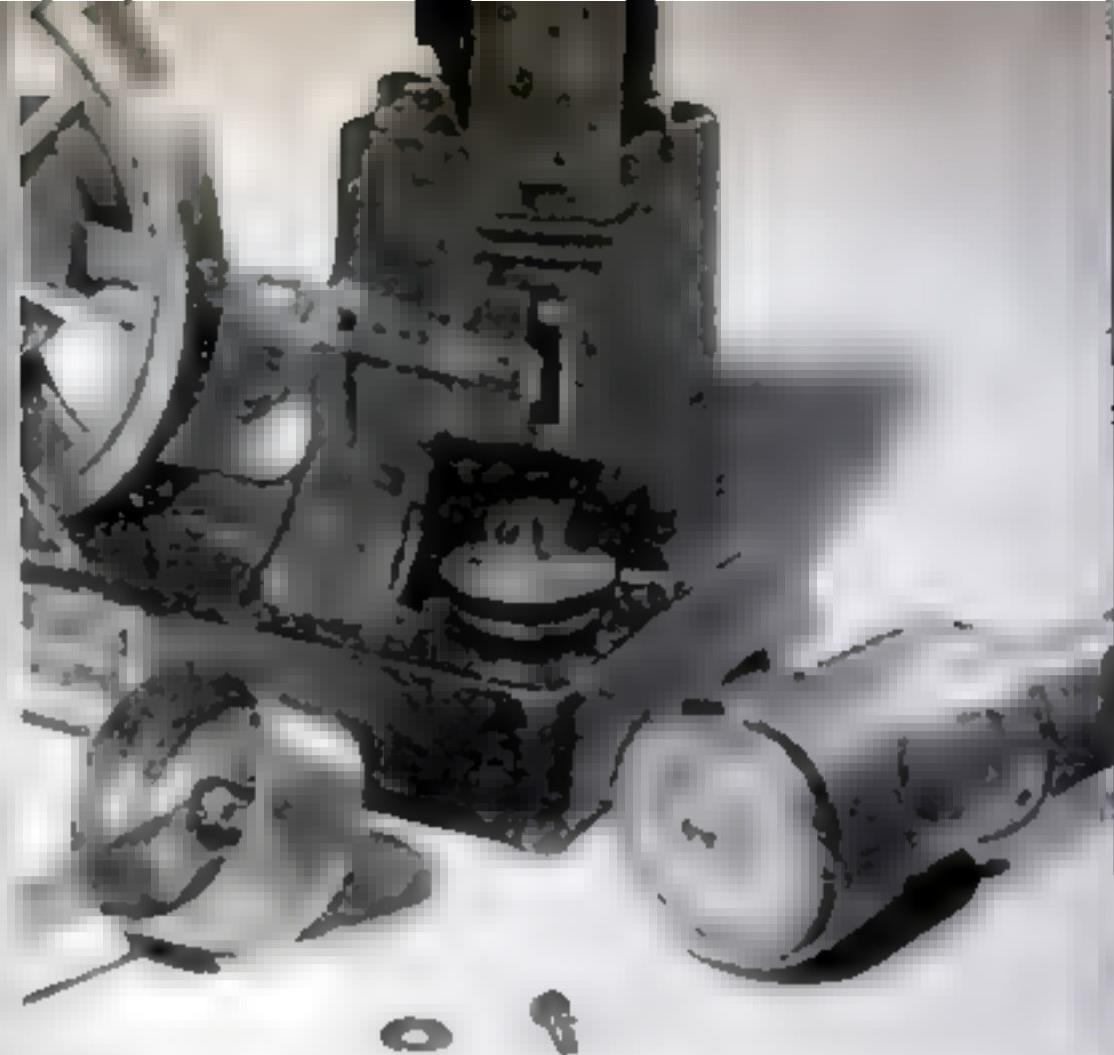
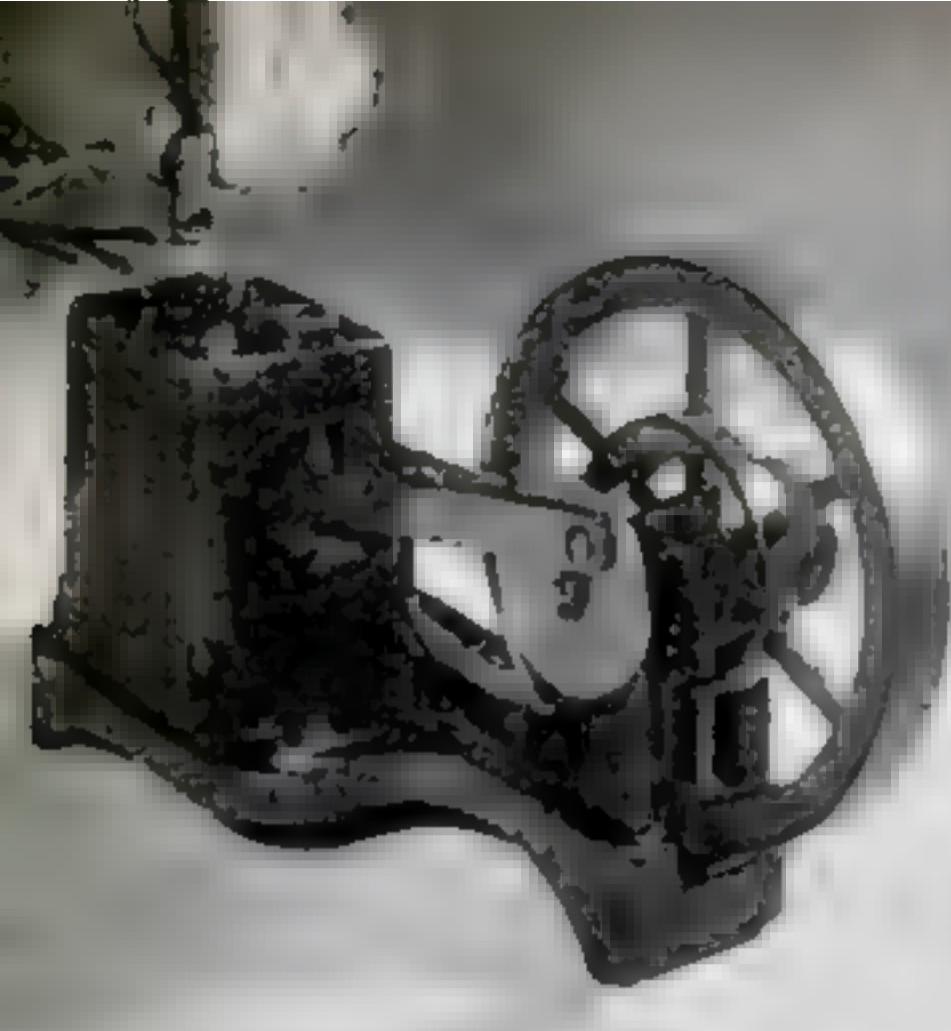
Faced with the pieces, questions came fast. The catch was that I didn't know all the answers.

- How did this engine work?
- What part is missing here?

Harry Walton, shown below with the finished engine, is a former mechanics-and-handicraft editor of *POPULAR SCIENCE*. Now a free-lance writer, he devotes part of his time to such delightful activities as described here and on page 150 ("8-Ball Racing"). But he gets around, too. He looked into how a Russian buys a car (page 81) in 1959 during his second auto tour of the Soviet Union.



CONTINUED



THE WHISTLE SHRIEKS LUSTILY at every revolution. To vent residual gases at the end of each piston stroke, there is also a small hole in the rear of the casting. A springless ball-check valve prevents inward leakage through the opening.

- Will this bunged-up piece do?
- What the heck is this for?

The last item was a whistle. I decided it had been added just for fun. This proved only half right.

I know how a vacuum engine works in theory. But an old one is an individual, not a labeled textbook diagram. It can have some sly tricks up its iron sleeve. Mine pulled them out one by one.

Dating from about 1920, it has an ugly main casting that comprises the cylinder (of 2" bore), shaft bearings, and a hol-

A SUPERIOR PISTON FIT is a must for any engine of this kind. It has to be nearly airtight to maintain the pressure drop on which the engine runs, but, with its low power, there must be no trace of binding or drag in the cylinder.

low base that serves as the fuel tank. The cylinder bore was as scored as if lubricated with coarse emery. The dented, thin-walled piston looked as if it had been last used to mash unboiled potatoes. The slide valve was missing, the shaft broken off the overhung crank disk, and the burner only a memory.

To work at all, this kind of engine requires an almost perfect piston fit. But it hasn't enough oomph to overcome the drag of rings or even packing. The score marks in the cylinder had to go. A new piston was needed.

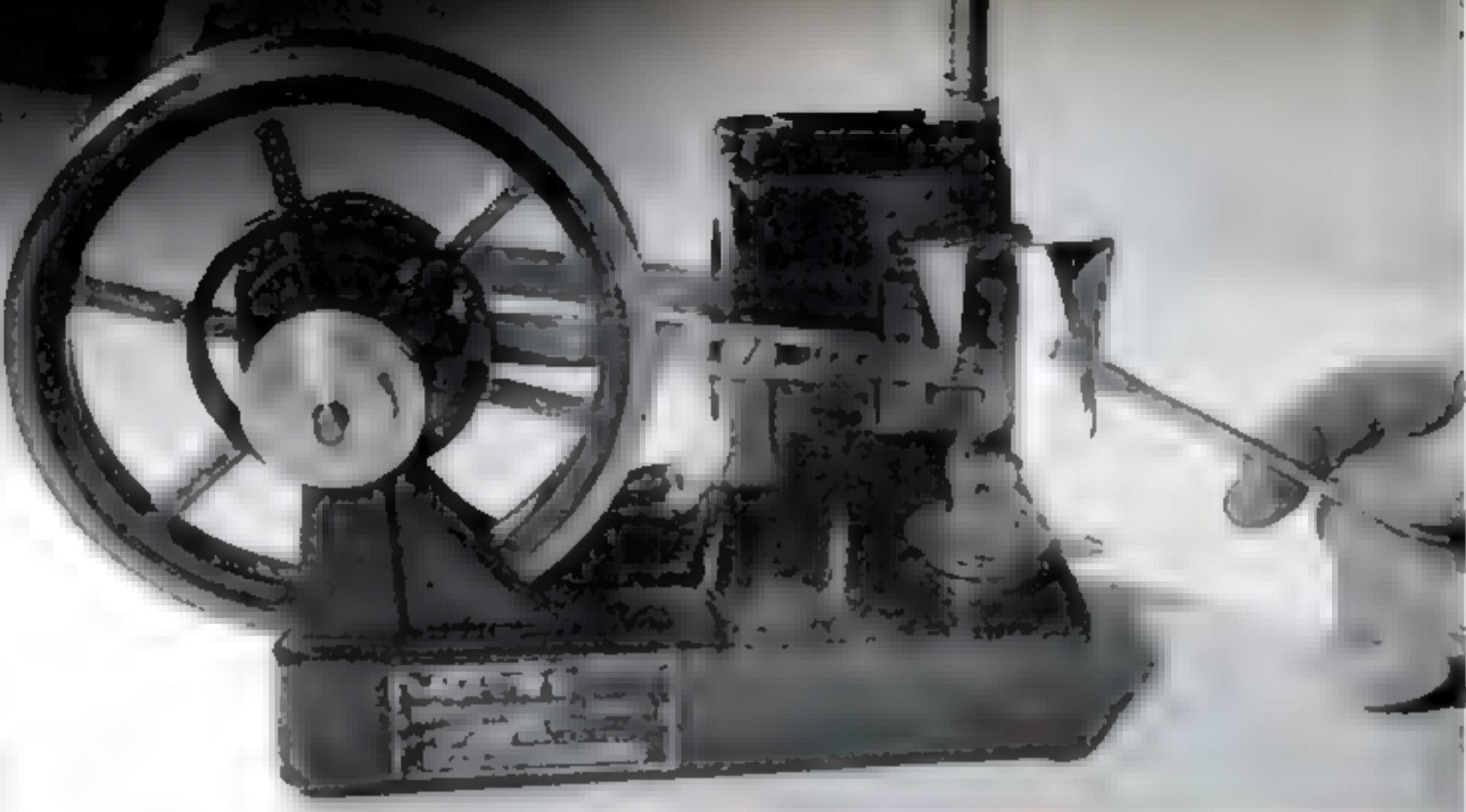
Honing the cylinder. That ungainly casting would have been murder to mount in a lathe. So I chucked a brake-cylinder hone in the drill press, held the casting on the table, and worked the hone up and down in the blind cylinder. Happily I saw the score marks come out, the bore gradually become smooth.

But when I caliperized that sleek bore, its diameter was one thing at the bottom, quite another at the mouth. For the kind of piston fit this engine needed, the tapered bore was useless.

I had overlooked the fact that the fairly long hone, working from one end of the blind hole, was bound to remove more metal from that end and less at



THE WHISTLE, I decided quickly, was just there for fun. Later, I learned how wrong I could be.



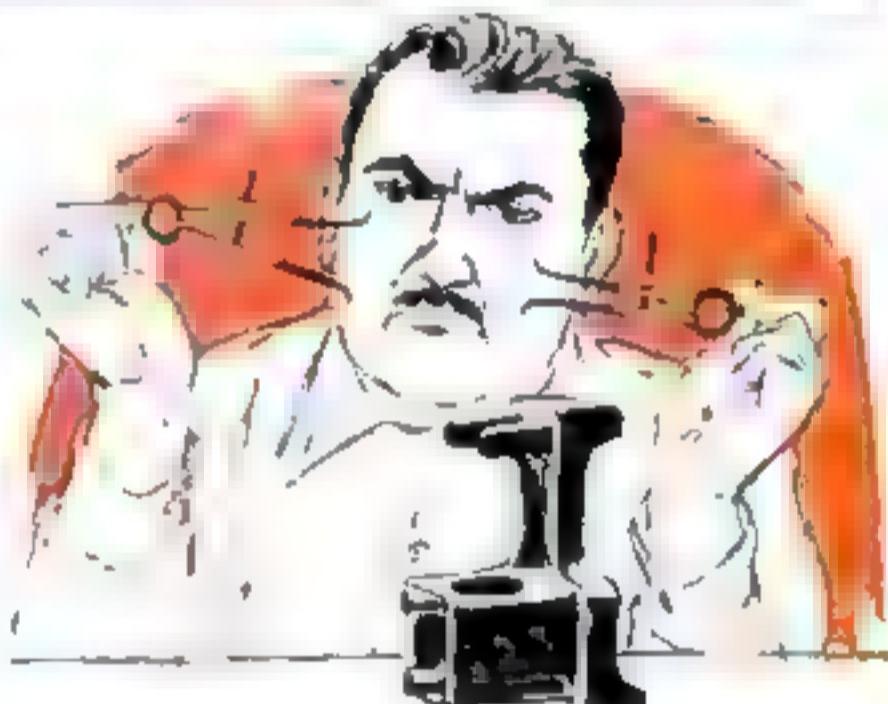
RUNNING FULL TILT, the engine slows down when the flame shield is raised. It gobbles calories—the flame is 2" long when not blown about by valve breathing. Smudged nameplate is the sad result of cleaning with solvent.

the bottom. To save the day, I'd have to reverse this condition, enlarging the blind end. As a desperate measure, I wrapped a few turns of solid wire solder around a small can, tacked them tight with a hot iron, and skim-turned the lot to a snug fit in the cylinder.

With valve-grinding compound on this wrapping and the can revolving in the drill press, I tried to lap the tapered bore selectively. As my primitive lap wore, I drove sheet-metal strips under the solder turns, uneasily aware that this made them out of round. But this crude method eventually produced a straight, smooth bore—uniform all the way down.

Cockiness restored, I was ready for my next blunder. The whistle, it turned out, retained a ball valve. I'd seen nothing like this on other vacuum engines, but I cleaned the seat, ball, and vent hole, and snugged everything back.

The finicky piston. Seeing no way to duplicate the deep-drawn piston, I bored out a 2" pipe cap to reduce wall thickness, then carefully turned the outside to a free-sliding—*whoops!* one fatal last pass made the fit far too free. With a second pipe cap, I did the job over, scarcely breathing on the crossfeed at the last. The piston was so airtight even



FIRST HONING JOB FLOPPED. I tapered the cylinder-bore ends to different diameters.

without oil that it popped like a champagne cork when yanked out of the cylinder.

So far I'd closed the port with my thumb, which wouldn't do with a fire under it. The missing valve had been held against the flat port face by a spring on the valve rod. I bent strip steel to form a right-angle lug, filed this to fit the hole in the spring, and lapped the valve surface until repeated tests showed it to be seating nicely on the port face.

A new shaft was easy. As a flourish, I turned the flywheel (still as rough as the day it was cast) smooth and true. It had an internal cam cast into it, and I set this to open the valve at top dead

[Continued on page 196]

An exciting way to race model cars
with realistic thrills and spills:

Here Comes 8-Ball Racing

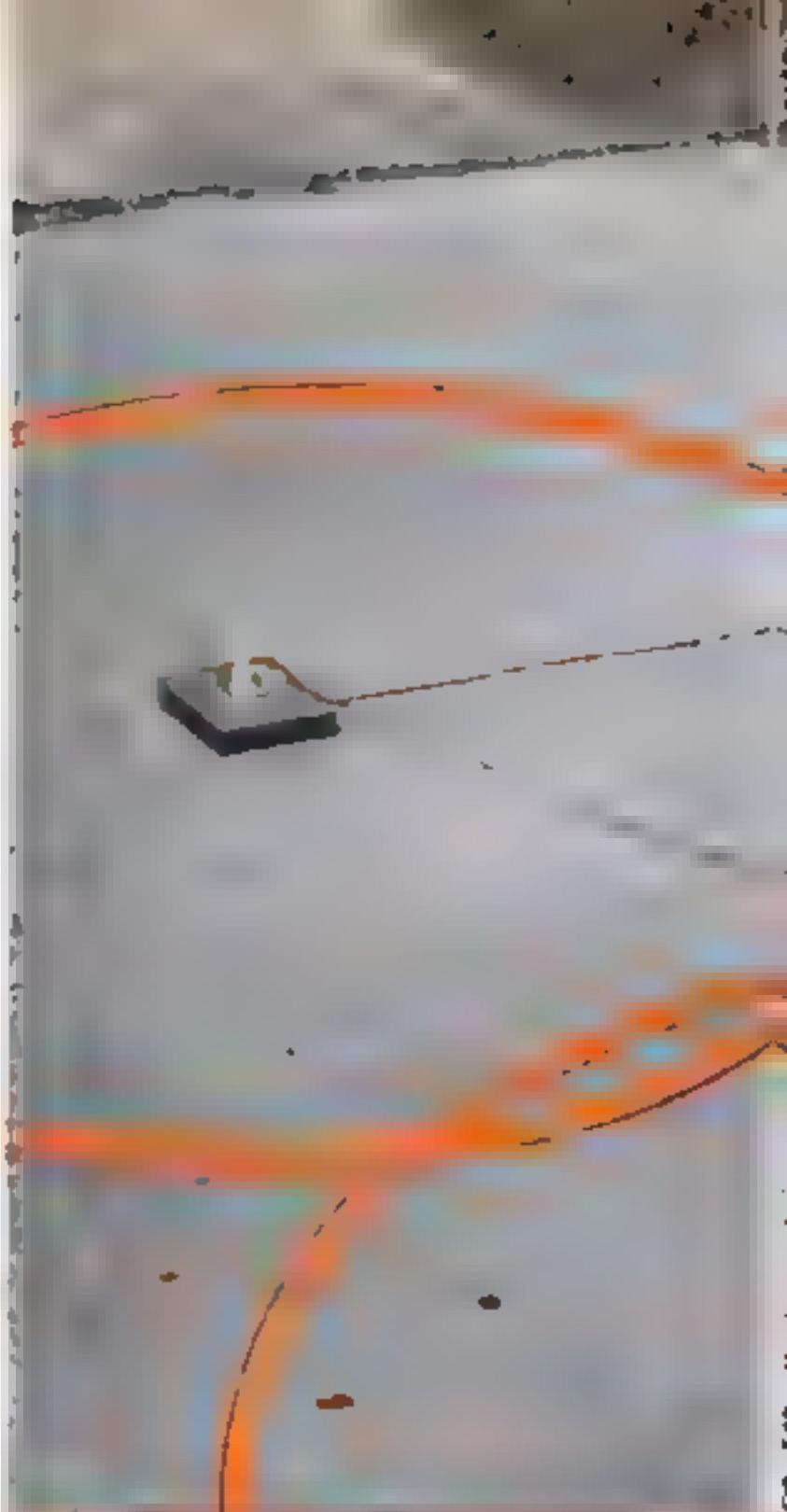
By Harry Walton

THEY'RE OFF as your car surges over the ramp, swings into the far turn, roars into the squeeze under your opponent's wheels. You come out ahead, but he gains half a length in the lap.

Riding his rear fender into the squeeze, you have to brake hard, spin in, and lose an instant more recovering. Next lap you'll have to bluff him out—make him brake to avoid a crash, or hit him just right without losing ground yourself . . .

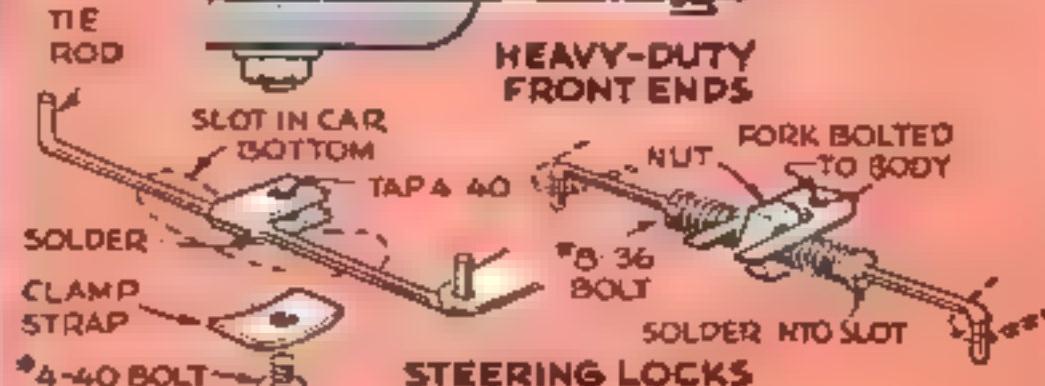
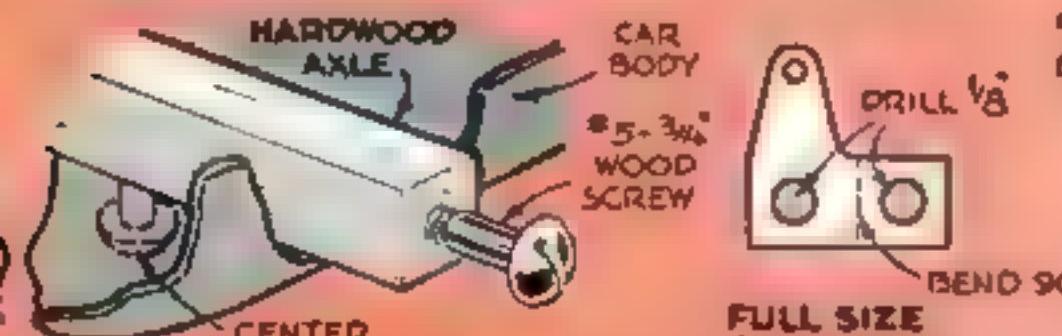
The thrills you get in this new kind of tether racing have no strings attached. Hairbreadth escapes, sideswipes that stagger both cars but leave them rolling, desperate efforts to get back on the track when headed for center field, crashes that spin cars end over end or knock off wheels are all part of the exciting game.

Powered from its center pylon, each car runs a circular course. But their circles overlap once each time around, the cars are on a collision course. To



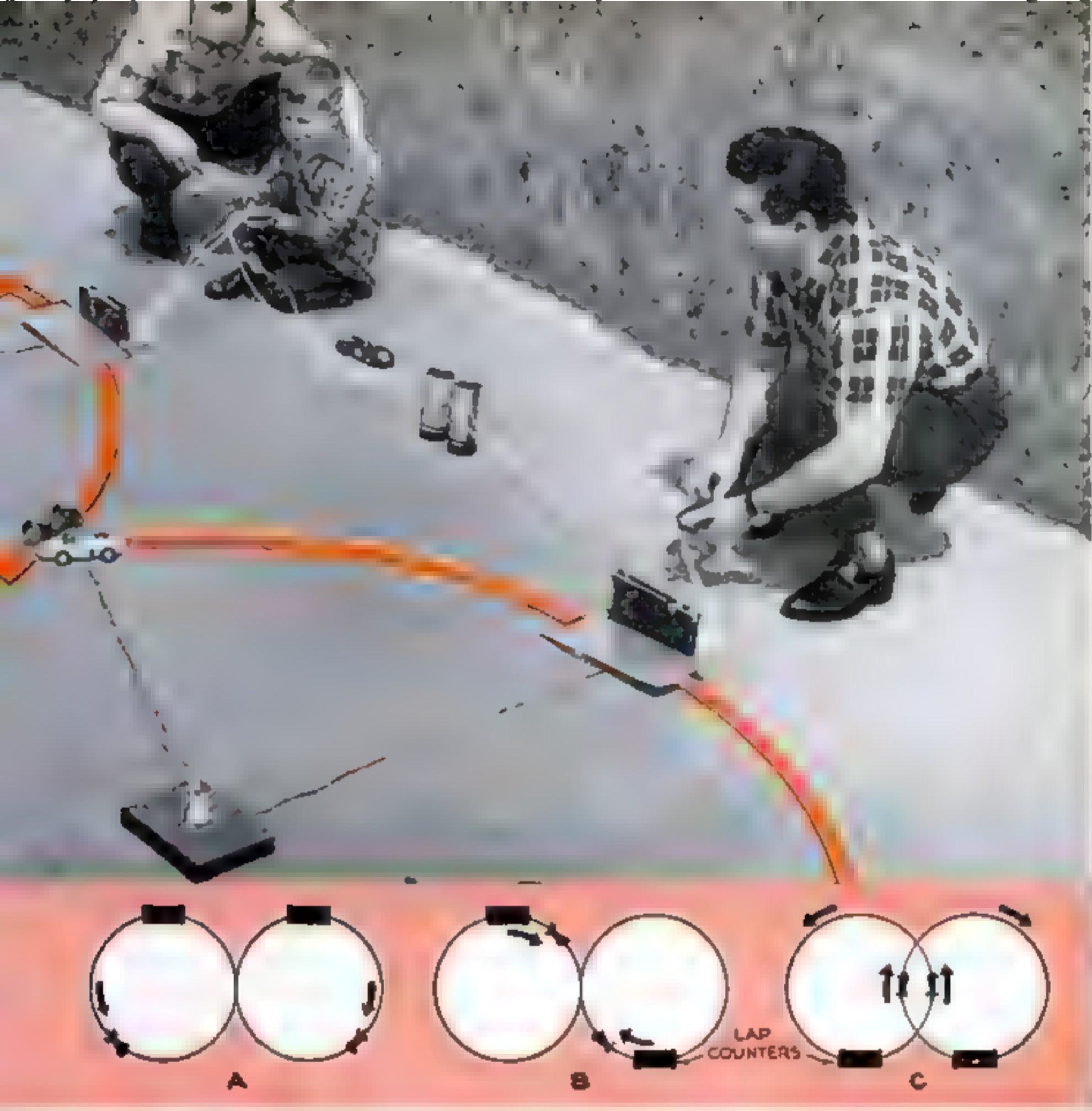
IT'S ALL-OUT ACTION as pylon cars race against each other on intersecting courses. Here they are running in opposite circles (A in the drawing at right). For extra excitement, try racing head-on as at B, or with pylons so close that circles intersect at two points (C), or even with three competing cars in a cloverleaf pattern.

Beefing up front ends to withstand crashes



BEND TOP AXLE STRAP to form forks in which steering knuckles swivel. Lock with a bolt or screw and adjust to desired height.





win, calls for fast reactions and nerve, right up to the moment your car leaps the counter ramp and its checkered flag snaps up.

Cars must be sturdy to take this rugged sport. Plastic ones built from two-dollar kits are well detailed, but have fragile front-wheel assemblies. Beef them up with homemade metal axles and knuckles, and you've got tough, fast little mini-racers.

Even a hardwood axle will do. Pivot it on a screw through the car floor, insert No. 5 screws as wheel spindles, and lock steering by tightening the pivot.

For real Ackermann steering, solder



STEERING IS CRITICAL, can win or lose the race for you. Too much turnout causes drag. Too little may slacken the tether, cause you to lose control. Cement cover over gear (indicated by arrow) to keep dirt from getting in

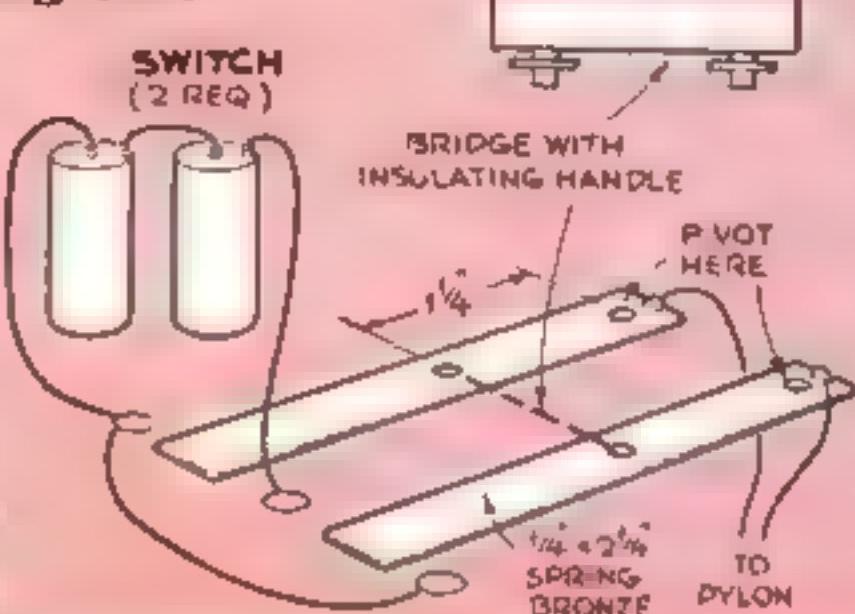
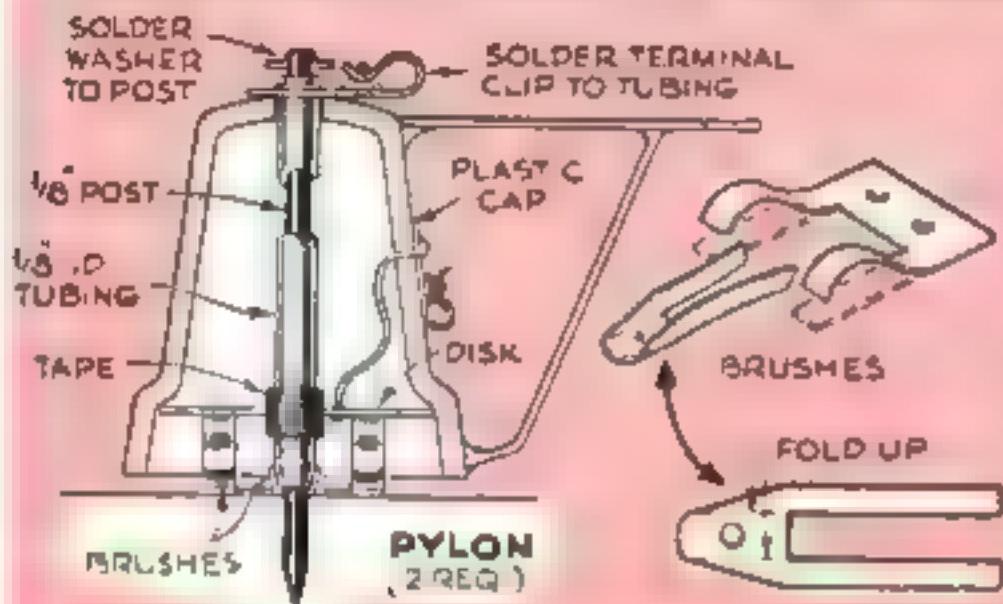


THREAD CAR TETHER through hole at end of the outrigger, wrap it around once and connect to rotor terminals. The double-thickness wood base is heavy enough to hold against car pull



TWO-BLADE SWITCHES have three positions—forward, center off, and reverse. A cover bearing against the bridge pivots will maintain good contact tension on the blades.

Pylons deliver power to the whirling cars



two pieces of $\frac{1}{16}$ " brass temporarily together. Drill and shape both at once. Unsolder and bend one opposite to the other for right- and left-hand knuckles.

Solder the spindles and kingpins together inside the brackets (if silver-soldered, they'll be almost indestructible). The axle is two strips of metal bolted together through the car floor.

The plain kingpin shown turns in clearance holes, car weight being on a washer soldered to the kingpin or on a bit of tubing slipped over it. The other mounting shown has a 5-40 bolt as the kingpin. It turns in a nut soldered over a clearance hole in the axle.

Pylons supply power. Make them of deep plastic caps from pressurized cans. Caps with an inner flange provide a good seat for the contact disk. The center post is $\frac{1}{8}$ " steel rod or a smooth nail. A piece of brass tubing turns on it.

Center-drill the cap for the tubing. Cut the disk from tin plate or brass, with a center hole bigger than the tubing. Chuck the tubing in a drill to file a $\frac{1}{4}$ "-long bevel at one end. Above this wrap tape to a close fit in the contact-disk hole.

Solder a wire to the disk, lead it through a hole in the side of the cap, insert tube and disk. Solder a Fahnstock clip atop the tubing to hold it. The disk can be locked in by softening the plastic under it with a soldering iron. "Weld" plastic measuring-spoon handles together to make the rotor arm. Mount the side terminal this way or with bolt and nut.

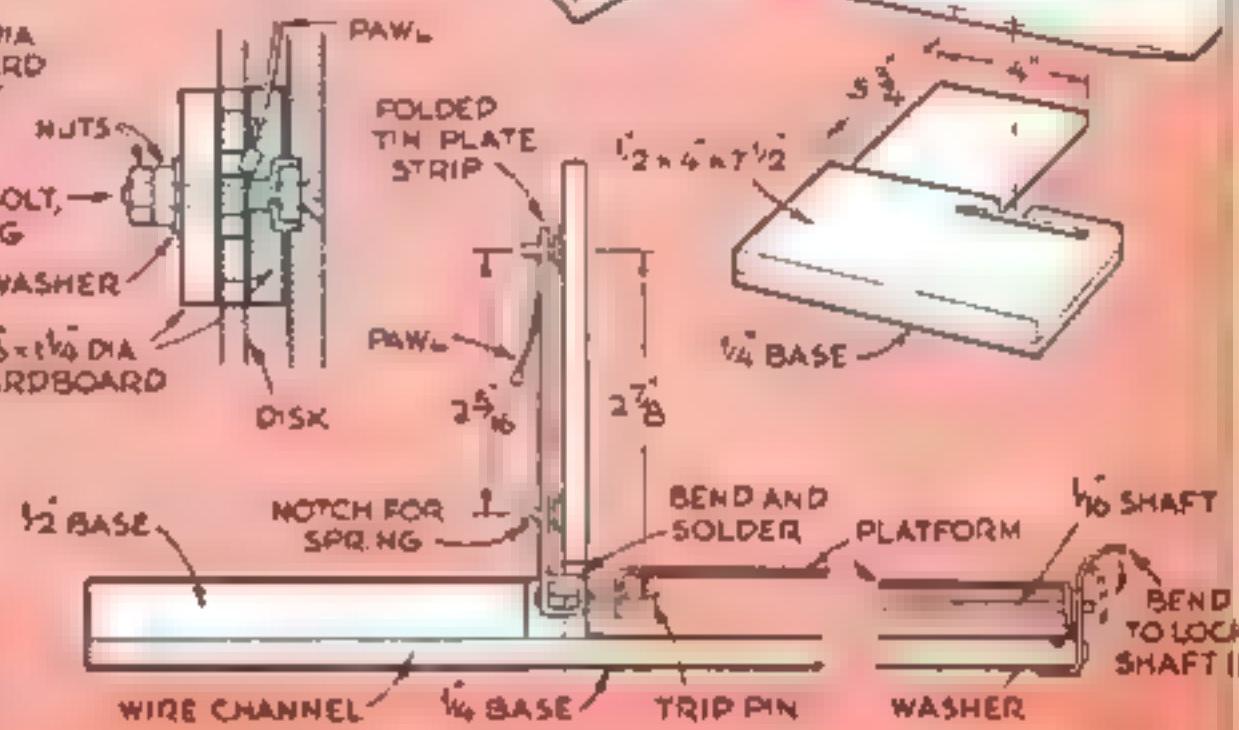
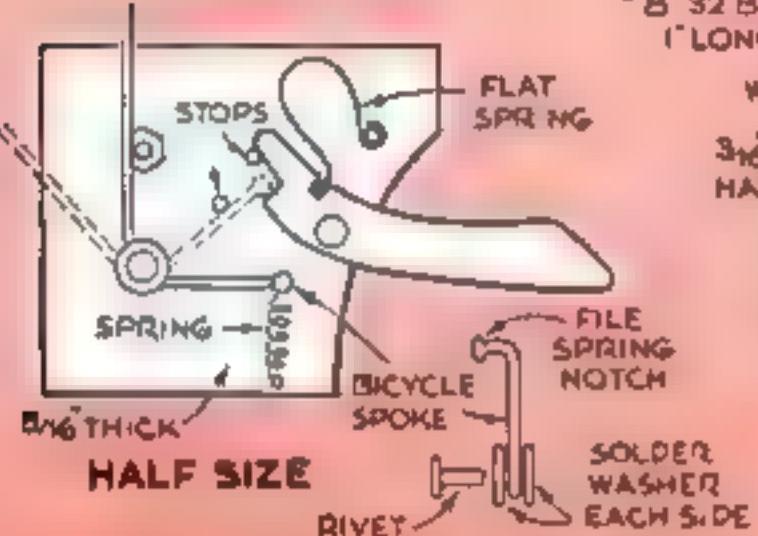
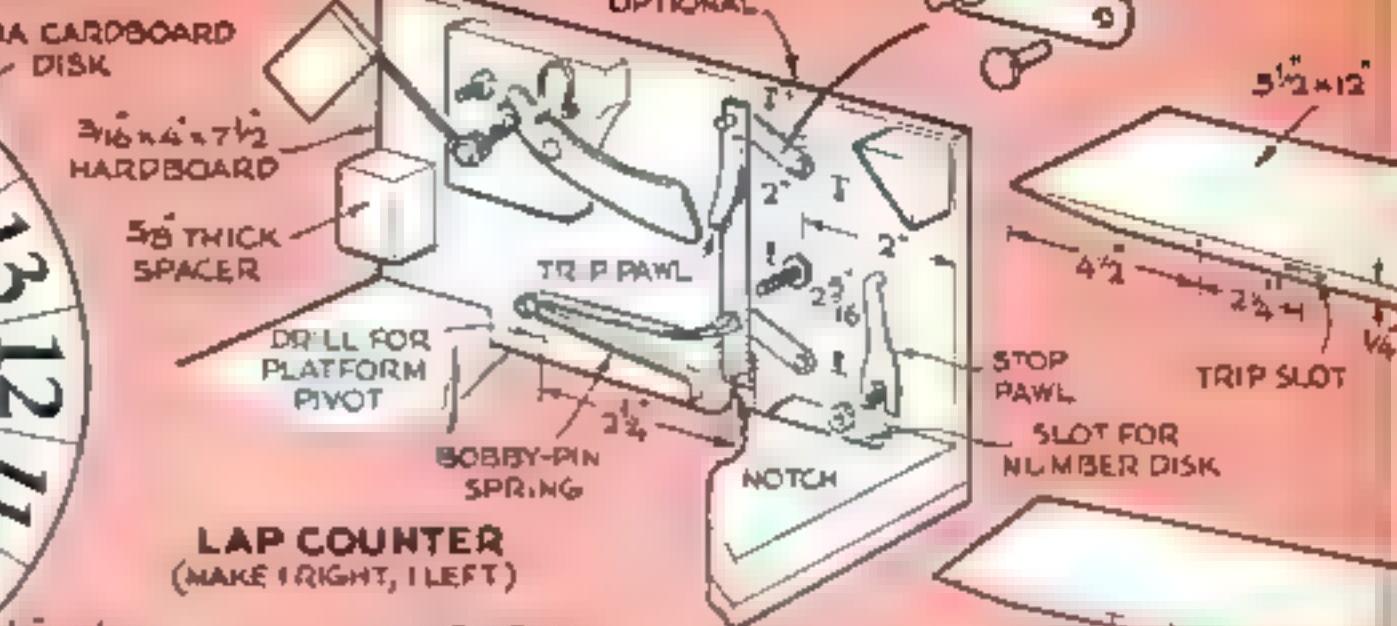
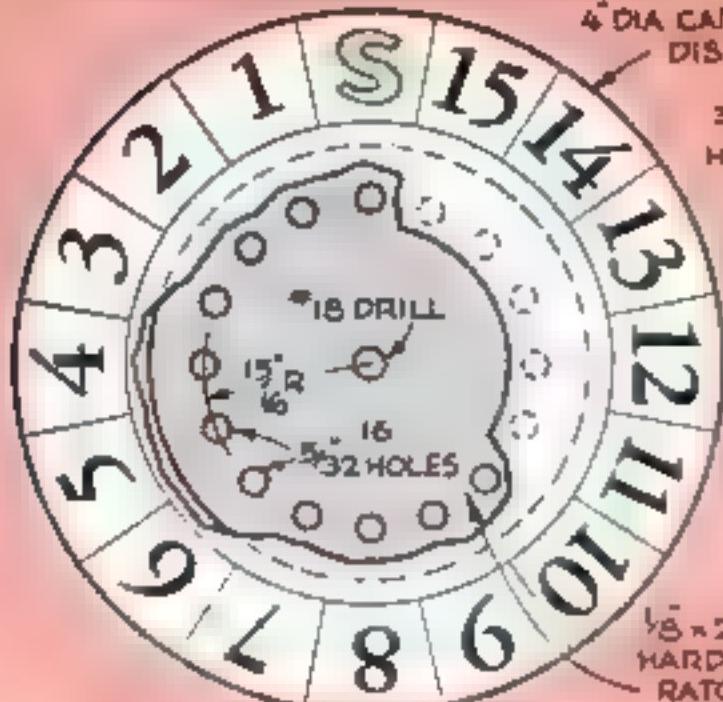
Cut brushes from bronze weatherstrip. The narrow one hugs the tubing bevel. Bend up the legs of the other brush to ride on the disk inside the cap, with enough tension to lift the rotor.

Solder a wire to each brush, lubricate both with petroleum jelly, slip on the rotor, and solder a retaining washer to the top of the post.

Knot the motor leads inside notches in the lower car-body section. Solder on stranded phonograph pickup wire as the running tether. Be sure to make the bridle legs of equal length. For counter-rotating cars, have one bridle emerge from the right, one from the left.

Drastic braking and swift backing to get the cars back on course are possible by reversing the motors. Make center-off

Automatic counters keep track of laps and flag down winners



CHECKERED FLAG FLIES UP as a winner hops the ramp. Lap numbers show in the notch cut in the cover. The mechanism is mounted on a panel (right) in which a second notch will display



numbers on opposite sides of the disks for spectators' benefit. The panel is fastened to a $\frac{1}{2}$ "-thick base, and this on an L-shaped $\frac{1}{4}$ "-piece grooved for the pylon wires.

switches as shown. The contact buttons may be thumbtacks or roundhead screws filed almost flat. Pivot strong, springy blades at one end, and mount a bridging strip on pivots. Solder the flexible pylon leads directly to the blades.

Two big dry cells give fast action on smooth surfaces. On rough concrete you may need three. A master switch on these turns on or cuts power to both switches,

assuring that cars get off to a fair start.

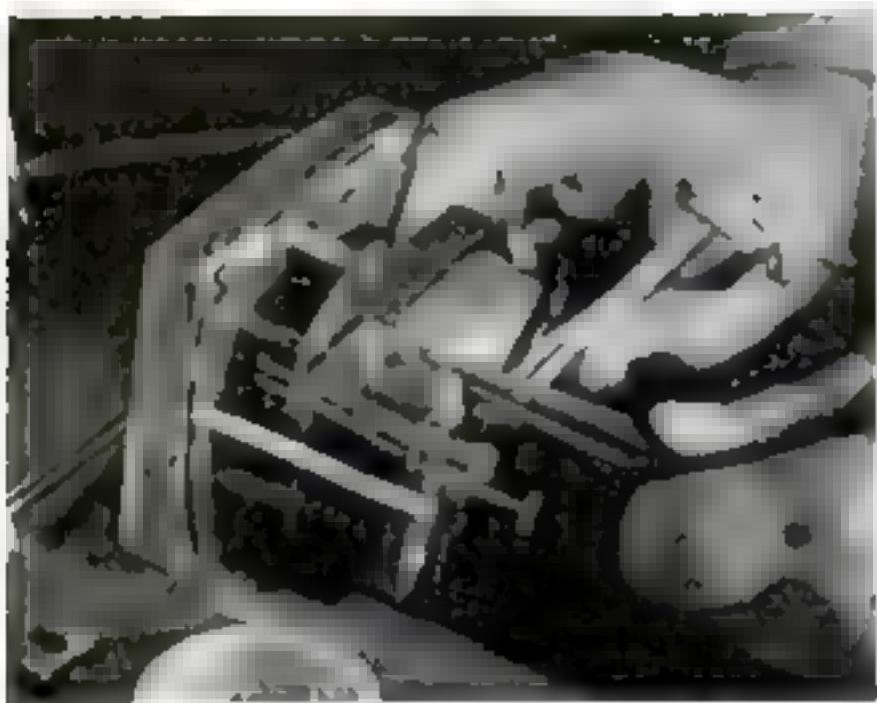
Automatic lap counters keep drivers and spectators on their toes by showing where cars place in the race at all times. If your cars are to race in opposite directions, make one right- and one left-hand counter.

Take pains to drill the holes in the ratchet disk accurately. Mount the disks,

[Continued on page 201]

Short Cuts and Tips

FROM PS READERS



Muffler for an Alarm Clock

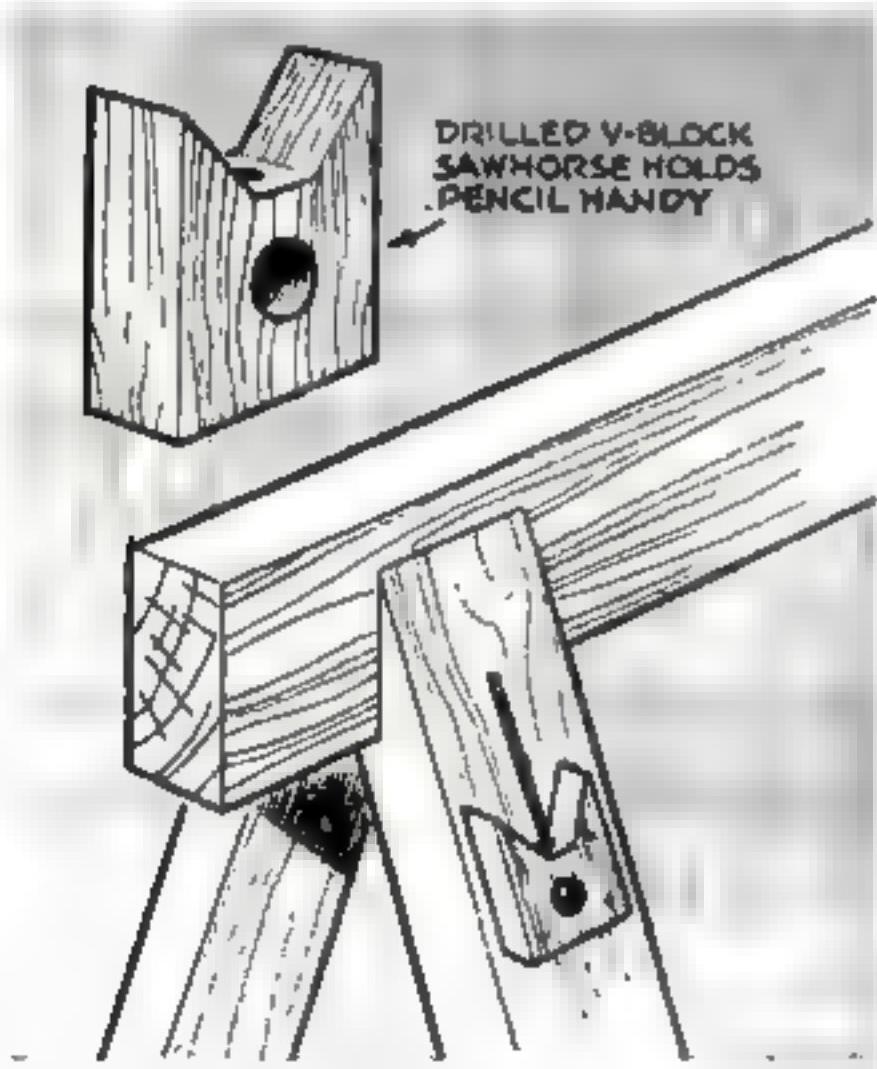
IF YOUR electric alarm clock buzzes too loudly, here's a way to quiet it. Remove the works from the case and locate the buzzer, a springy strip with its end bent within reach of the magnet core. Note where it touches the core when pressed toward it.

At this point, wrap a narrow strip of cellulose tape once around the spring. Be sure not to bend the strip. Pinch the tape on tightly underneath and overlap it on top. Secure it with a dab of cement. —*Harry Walton, White Plains, N. Y.*



A Mirror a Child Can Reach

BATHROOMS are not designed for small fry. Even when they're tall enough to use the basin, the medicine-chest mirror is over their heads. If the chest has a projecting wood frame, suspend a small framed mirror from its base rail with hooks and eyes. It's easily detached for cleaning.—*Basil Jackson, Downsview, Ont.*



Sawhorse Holds Its Own Pencil

IT'S annoying to grope for a pencil when you're ready to mark work laid on sawhorses. A drilled V block tacked to one of the legs will keep a pencil always handy. A hole large enough to take the pencil is drilled through the crotch and into a larger hole bored from the face. The crotch guides the pencil into its well, making it easy to replace. The hole in the side keeps the pencil holder from getting clogged up with sawdust.—*G. E. Hendrickson, Argyle, Wis.*

►►► WHEN patching walks or repointing stonework, you can give the cement an appropriately rough surface by finishing it off with a cheap paintbrush moistened in water and shaken nearly dry. Rinse out the brush immediately afterward and save it for the next cement job.—*Ken Kraft, Pebble Beach, Calif.*



How to make and use a **GAB Meter**

**Simple accelerometer gives quick answers
to most questions about your car's performance**

**By Joe Whitehill
and Hubert Luckett**

HERE'S a device you can build for about \$5 that tells you in meaningful numbers just about anything of interest concerning the forces affecting your car's behavior. You mount the GAB meter with suction cups to the right front window. There are no wires or other connections.

You can spot gradually dropping brake

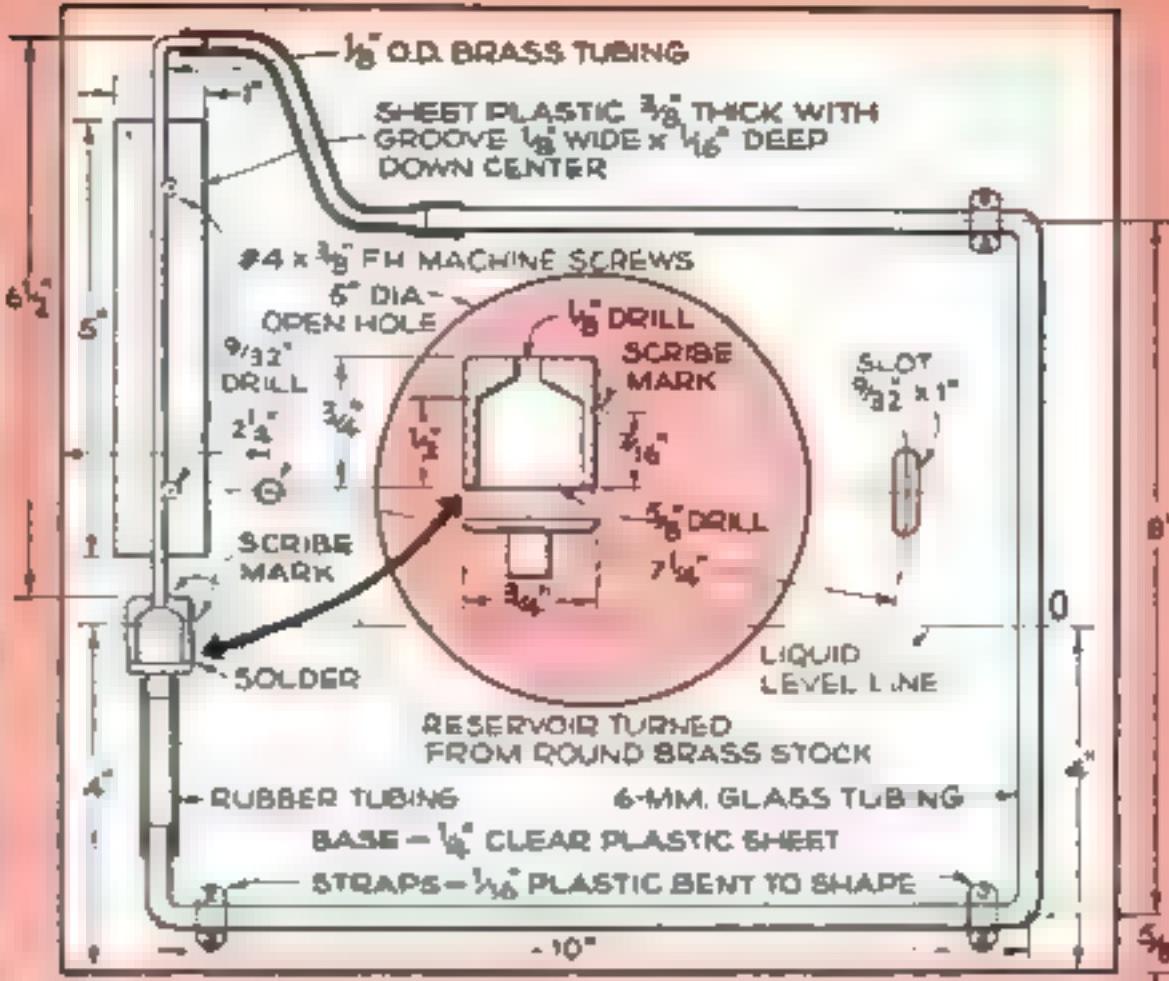
efficiency long before an emergency proves you waited too long. You can tell at a glance whether a certain brand of gas really gives your engine more pep. You can add interest, pleasure, and knowledge to your driving in dozens of ways when you supplement your judgment with repeatable measurements. Specifically, the GAB meter measures:

- Drawbar pull in pounds force per ton of vehicle weight.
- Brake efficiency in percent of the

*** Gradient Acceleration Brake Meter**

CONTINUED

This is how you make a GAB meter



BEND GLASS TUBING by heating until the flame turns yellow. Turn tubing continuously in the flame to insure uniform heat. Cut to length by scoring with a three-cornered file and snapping

with a sharp bending motion. After soldering reservoir and ricer, mount assembly on sheet-plastic base and accurately locate the parts in relation to the liquid level line.

maximum braking effort theoretically possible.

- Slope of a hill in percent grade.
- Total drag in pounds per ton.

Drawbar pull is a term auto engineers swiped from railroading. It is the force available for performance (hill climbing and/or acceleration) after the engine has overcome rolling resistance and air resistance. It's sometimes called "surplus thrust," "surplus force," or simply "pull."

Braking force cannot exceed the force of gravity holding the car to the road surface. So the theoretical maximum is equal to the weight of the car. This is a force of one "g." Tires will skid before this is reached. With excellent brakes, tires, and road surface, over 90 percent of the maximum may be achieved in an emergency stop from 20 m.p.h. Good brakes frequently will show around 80 percent. Ordinarily you can expect around 60 percent.

Percent grade of a hill indicates the rise per 100 feet of horizontal distance. This can be read directly on the left-hand scale of the meter when the car is climbing a hill at constant speed.

Drag is the total resistance the engine must overcome to maintain a constant speed on level ground. It consists of both the frictional resistances in running gear

and tires, and air resistance. At low speeds, most of the drag is due to the former; at high speeds, the latter. The meter scale below zero shows drag in pounds per ton up to 100—sufficient to show rolling resistance at low speeds.

How you use it. The most valuable use of the GAB meter is for comparison measurements. You can get the essential information in a few minutes. You need only a few hundred yards of reasonably level road, a speedometer, and an observer to make notes of the meter indications.

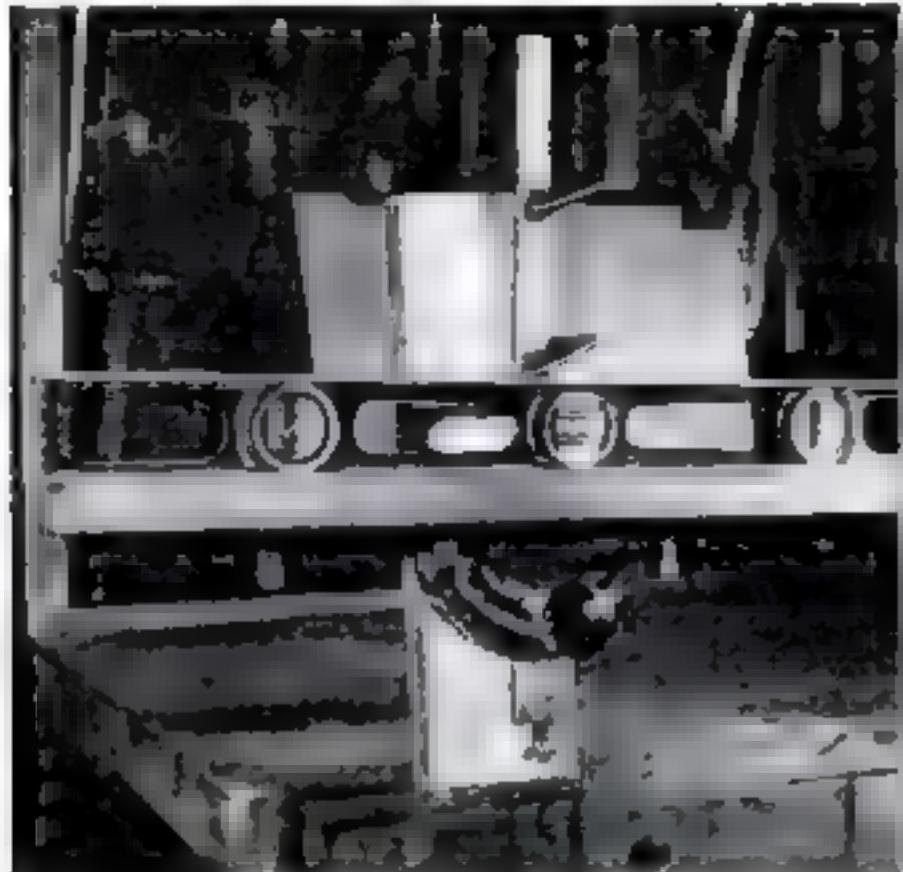
Three measurements will tell you practically the whole story about the operating condition of your car. Made periodically, they will show up gradual deterioration or the effects of tune-ups and repairs. You'll soon have a good picture of the normal performance to expect.

The basic measurements are:

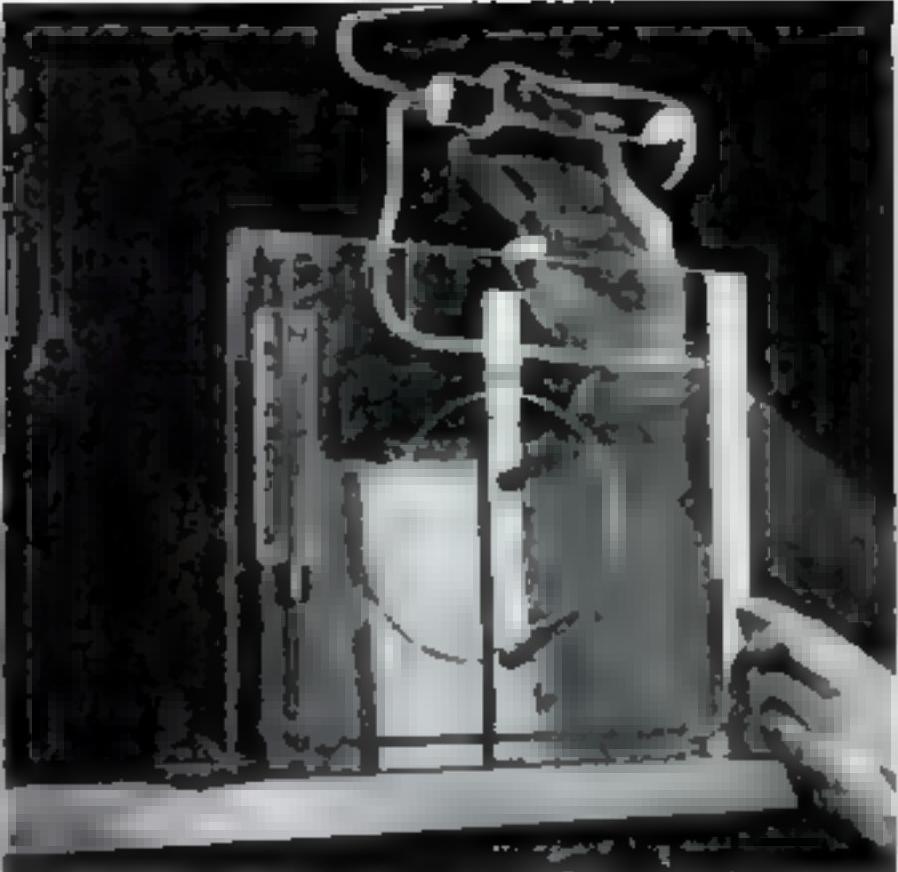
1. Maximum pull, accelerating in high.
2. Drag, coasting at slow speed.
3. Maximum brake efficiency with full brake application at moderate speed.

First, drive at a steady 10 to 15 m.p.h. until the meter has settled on zero. Step on the gas and note the maximum pull and the speed at which it occurs. With torque converters it's best to choose a speed—say 25 m.p.h.—and read pull when that speed is reached.

Calibrate it with a protractor and level



EASIEST WAY TO CALIBRATE is to use miter gauge from a table saw. Clamp the guide bar to a length of wood held upright in the vise. Level the head with the gauge set at 90 degrees.



CLAMP GAGE METER to working face of miter gauge. Use water colored with food coloring to fill U tube to zero mark. It'll take patience to get exact amount with no air bubbles.



TIFF THE MITER GAUGE to each angle shown in the table at right and mark the corresponding liquid height on the temporary scale. This can be replaced later with a permanently inked one.

Next, drive at 25 m.p.h., shift to neutral, and let the car coast. Note the drag reading when the speed reaches 15 m.p.h.

Finally, make an emergency stop from 25 m.p.h. and note maximum brake efficiency.

While this basic function alone makes the meter worthwhile for the thoughtful driver, there are many other interesting

CALIBRATION CHART

Acceleration

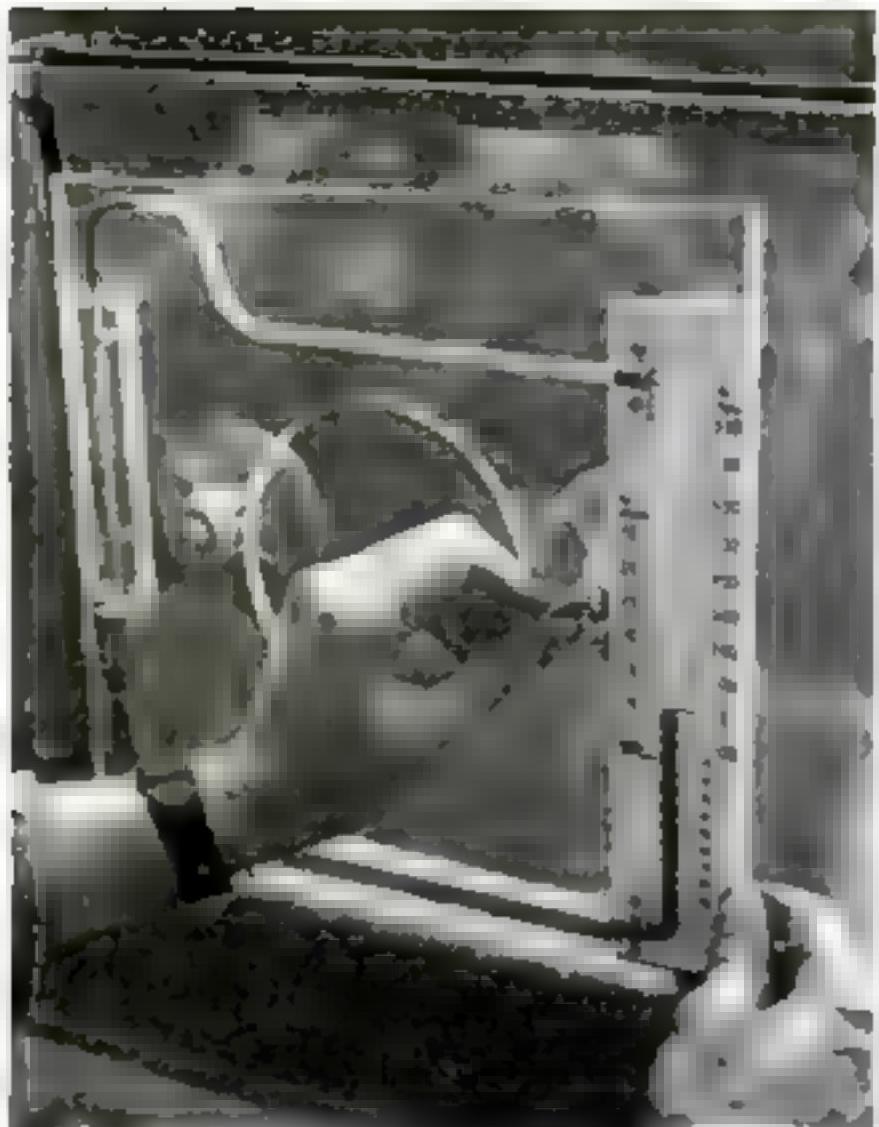
ANGLE DEGREES	LB. PULL PER TON	PERCENT GRADE
2.9	100	5
5.7	200	10
8.6	300	15
11.5	400	20
14.3	500	26
17.2	600	32
20.1	700	37
23.0	800	44

Brakes

ANGLE DEGREES	BRAKE EFFICIENCY PERCENT
5.7	10
11.3	20
16.7	30
21.8	40
26.6	50
31	60
35	70
38.6	80
42	90
45	100

and useful ways to use it. Here are a few suggestions:

- Find optimum shift points with a manual transmission. Most drivers tend to shift too late to take advantage of maximum pull in each gear. By making pull vs. speed curves in each gear you get a complete picture of the possibilities.
- Find maximum level-road speed (it



METER IS ZEROED with the car parked on level ground. Check by turning the car around and parking in the same spot. Readjust to split the difference between the two indications.

won't keep you from getting a ticket). When the meter hits zero with the accelerator fully depressed, you're traveling at maximum level-road speed even though you may be going downhill at the time.

- Estimate the maximum grade you can climb at steady speed pulling a trailer. You'll get the maximum pull on a hill by depressing the accelerator while traveling at your chosen speed. Multiply this figure by your car's weight in tons and then divide by the weight of trailer plus car. Locate the answer you get on the pounds-per-ton scale. Opposite it you'll find the gradient on the percent-grade scale.

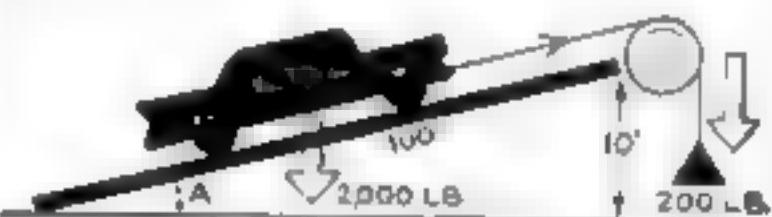
- Resolve arguments that arise in any GAB fest when car buffs get together—without need of a race track or drag strip.

How to make it. The GAB meter is essentially a U tube partially filled with colored water. The departure from a simple U tube of uniform cross section is to provide a compressed scale to indicate braking efficiency. Without this ingenious design, it would be impossibly awkward in size.

There are only two critical parts to
[Continued on page 206]

PULL... how you can measure it

Suppose it were possible for your car to climb a vertical wall. The force required to keep it moving at a steady speed up the wall is equal to the weight of the car. If we forget about friction for the moment. The force of gravity acting straight down, in line with the direction of travel, would have to be equaled by a force acting straight up. If the car weighs 2,000 lb., the force required is 2,000 lb. or one "g."



Now imagine the wall tilted to make an angle (A) with the horizontal. Gravity is no longer acting in line with the direction of travel so only part of the weight must be equalled to maintain a steady speed. The exact amount depends on the angle. If the car travels 100 feet to rise 10 feet above the horizontal, then the force required to pull it at a steady speed is 1/10 of the car's weight, or 1/10 "g"—200 lb.

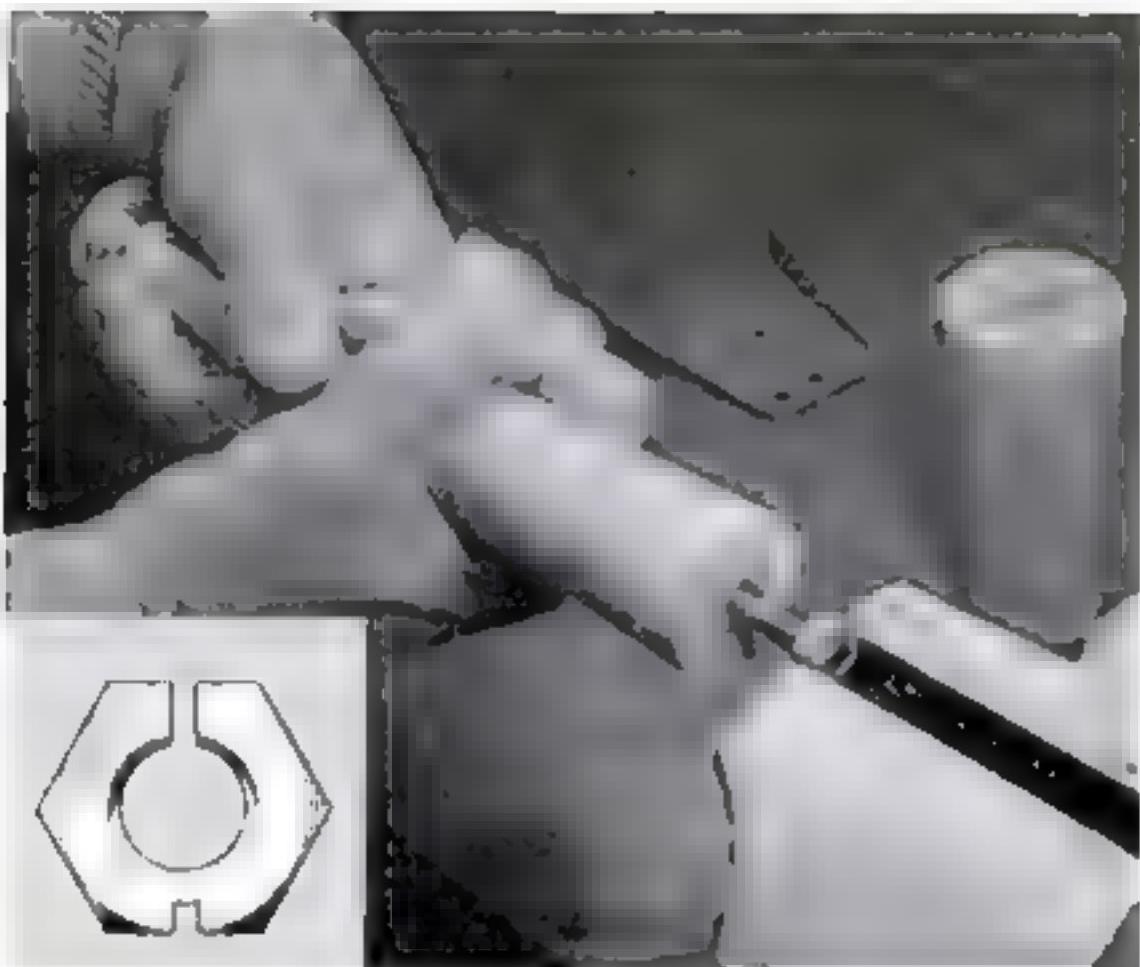
With a speedometer to help maintain a steady speed, all you need to indicate the pull your car is exerting in climbing a hill is an instrument that will indicate the grade. In addition to the gradient scale, it can also be marked directly in pounds pull per ton of vehicle weight.



If a force in excess of that needed to overcome rolling resistance and air resistance is exerted on the car when it is on a level road, it will be accelerated. The meter indicates this force the same as it would if you were climbing a hill. It makes no difference to the meter whether the force is overcoming gravity or inertia. To compute linear acceleration in m.p.h. per second, use this formula:

$$\frac{\text{lb. pull per ton}}{2,000} \times 22$$

The figure 22 represents the acceleration of gravity (21.94 m.p.h. per sec.).

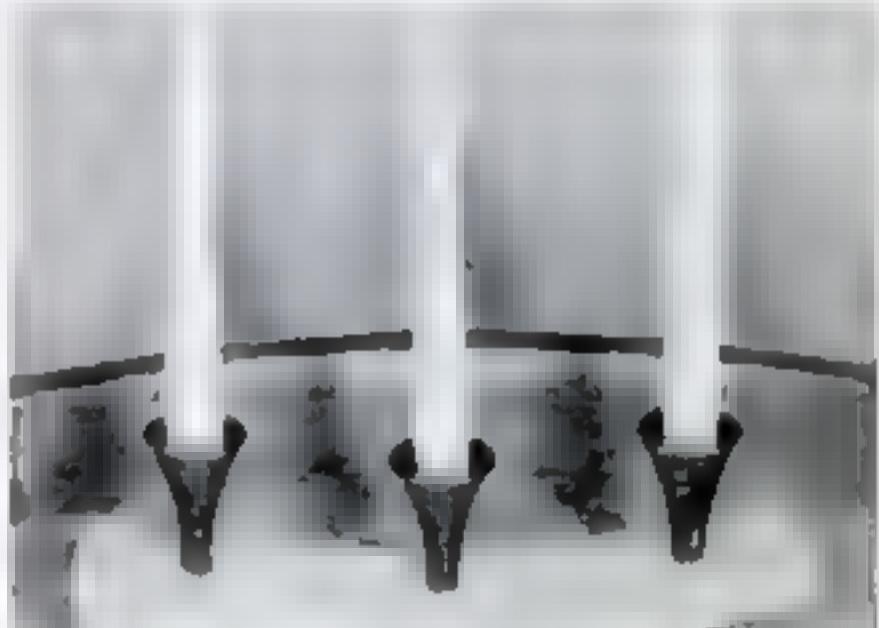
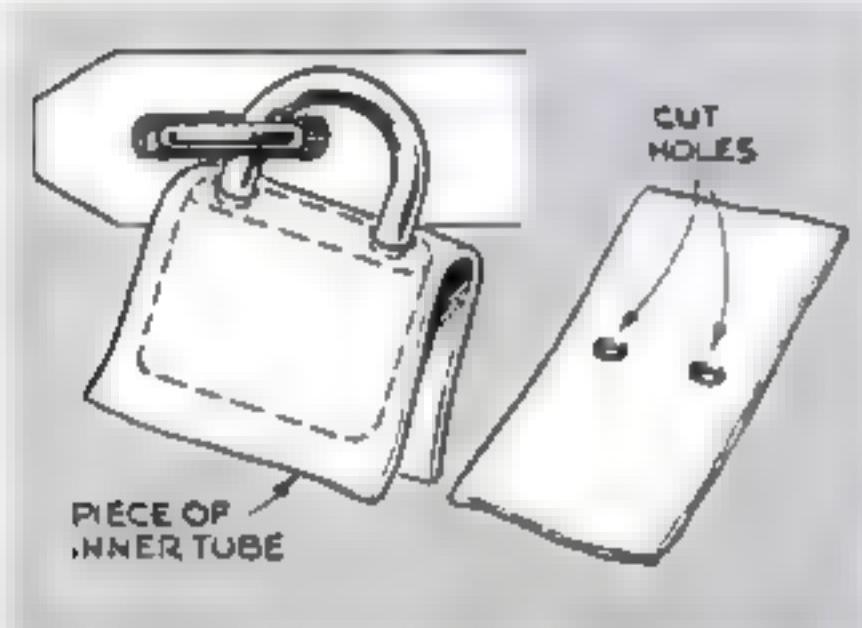


Short Cuts and Tips

from our readers

Split Nut Clamps Bolt Threads

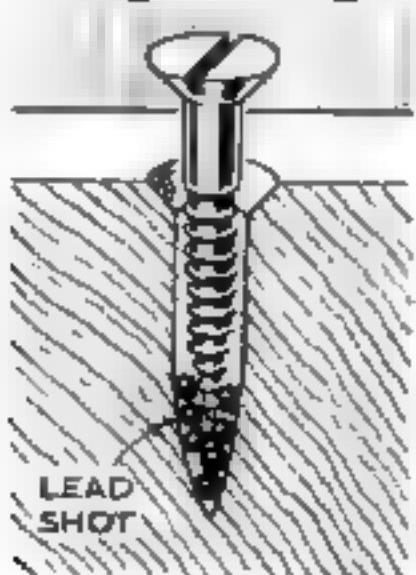
WHEN you want to install or remove a threaded stud without damaging the threads, screw on a nut that has been hacksawed all the way through on one side and halfway on the opposite side (see drawing). Squeeze the nut in a vise and it will clamp the stud tight.
—W. E. Burton, Akron, Ohio.



Rubber Shields Keep Locks Dry

THE padlocks on my outbuildings always rusted and froze until I covered them with rubber "saddle blankets" cut from old inner tubes. Punching two undersize holes for the lock bolt makes a snug fit and keeps the rain out.—William B. Eagan, Maceo, Ky.

Retightening Loose Screws



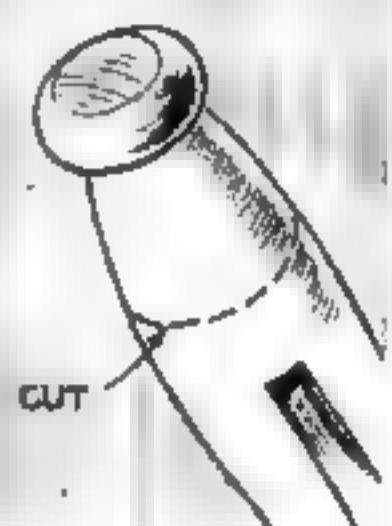
A wood screw that has loosened will hold firmly if you drop several small lead shot into the hole. When the screw is replaced, the threads will jam in between the shot and bind tightly as in drawing at left.—Ken Murray, Colon, Mich.

Old Chairs Yield Curved Stock

AN OLD broken chair back may seem useless, but the curved pieces of fine hardwood are perfect for decorative projects like this candle holder. The holders themselves can be turned from contrasting hardwood for an eye-catching novelty.
—Richard O. Bertz, Johnsville, Pa.

Small Knobs from Clothespins

RECENTLY I needed some tiny drawer knobs for an antique doll's dresser, but couldn't find any small enough. I cut off the ends of round wooden clothespins. Sanded and stained, they looked fine.—Charles K. Arey, Tuscaloosa, Ala.



7 Extra Uses for Wading Pools

ICE TUB. Filled with ice and placed in the shade out of sight of guests, a pool is fine for keeping beverages cool at a big outdoor gathering. It will handle several cases of soda pop.



LEAF CARRIER. A pool makes a fine carrier for autumn leaves that have been raked into a central place. They can be dumped onto the pool and dragged to the disposal site.



TENT FOR THE KIDS. Turned upside down and placed over a broomstick, a pool makes an excellent temporary tent. The bottom of the pool has enough give to provide good headroom.



STORM SHELTER. For a sudden summer storm, the lawn furniture needn't be carried back to the garage. Just stack everything in a neat pile, cushions and all, and cover with a pool.



WASH TUB. Canvas awnings, scatter rugs, Venetian-blind slats, and similar awkward items can be cleaned effectively in a pool. It provides much more elbow room than the average tub.



SANDBOX. An old pool can serve as the base for a sandbox, especially at a temporary location. It's much easier to remove sand from a pool than from lawn that you want to reseed.



WATERING PLANTS FAST. Thirty or more potted plants or seedlings can be watered simultaneously by standing them in a pool in an inch of water. The plants will then soak up water.



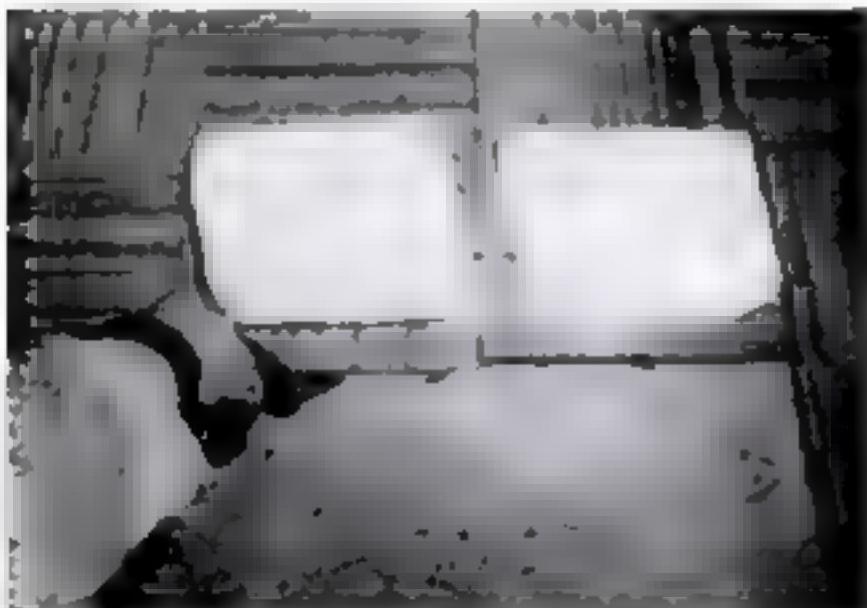
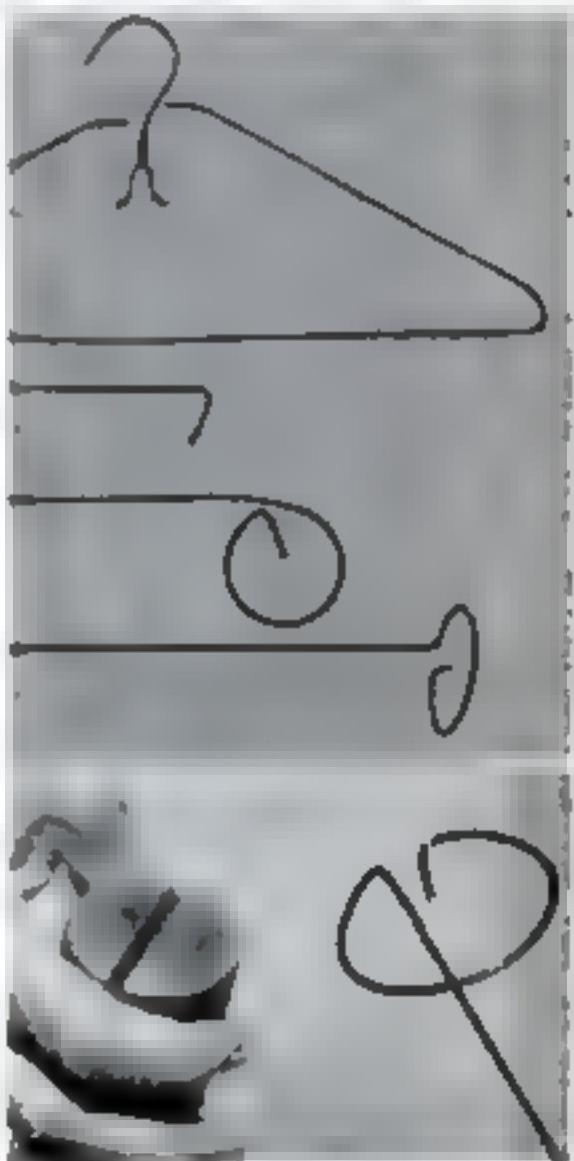
How to Make Plant Supports

WHEN the supply is unlimited, it's unbelievable how many plant holders like this you can use in a garden. They are especially good for plants knocked down in a storm or for tall ones that always need support.

Make them from coat hangers. Cut the hook section from the hanger and straighten the rest of it. Bend about an inch of one end at a right angle. A notched forming block made from a large dowel, as seen in the photo, will make the rest of the job a whole lot easier.
—Fern and Rowland Hill, Royal Oak, Mich.

Short Cuts and Tips

BY OUR READERS



Freezing Freez Asphalt Tiles

OLD asphalt tiles come off easily if you first cover them with slabs of dry ice. The rapid freezing loosens the cement, and the tiles pop up or can be pried off. You need only a few pieces of dry ice, moving them from one tile to another.

The method is especially useful where you want to remove only a few damaged tiles without replacing the entire floor. Dry ice can be obtained from ice-cream parlors, dairies, and ice companies. Handle it with gloves to avoid "burns."



Hammer Gauges Screw Size

IF YOU don't have a gauge to determine the drill size for a pilot hole, try using the claws of your hammer. Insert the screw shank, as shown above, and make a mark opposite its center. Now use a drill just enough smaller to fit below this mark.—Bil Toman, Palatine, Ill.

►►►When installing a window pane, moisten the glazier's points and they will stick to the glass until you can drive them.—W. F. Ruisinger, Kansas City, Mo.

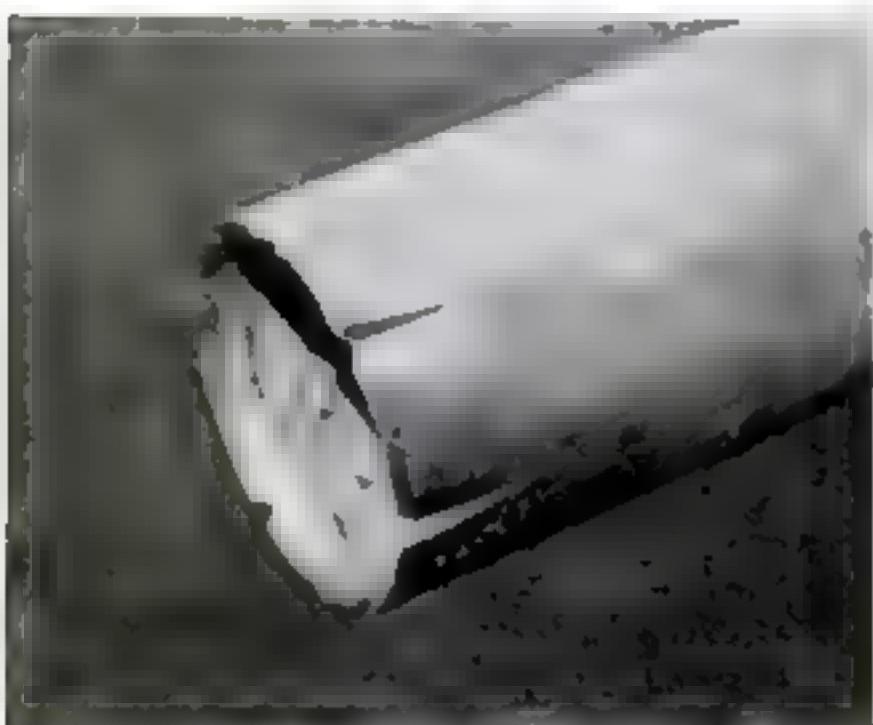
Short Cuts and Tips

FROM PS READERS

How to Make a Scaffold Anchor

LADDERS make steadier scaffold supports if they are "tied into" adjacent walls. Clamp one end of a wood strip to any projection, such as a window sill (using a scrap block to prevent marring), and nail or clamp the other end to a rung of the ladder.—*John Ericson, Santa Monica, Calif.*

►►►LIFTING a large panel of $\frac{3}{4}$ " plywood is easier if two 3" C clamps are attached at the upper edge to serve as handles.—*John F. Marshall, Newburyport, Mass.*

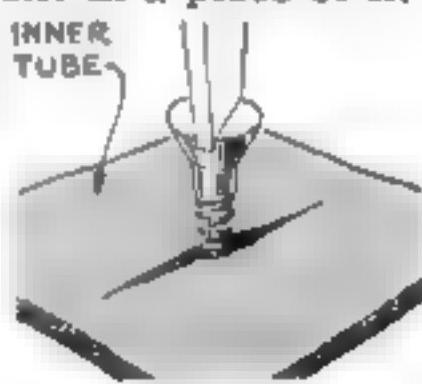


Fence Post Digs Its Own Hole

HOLE digging can be eliminated for pipe posts by filing a cutting edge on the bottom end of one of them. Use a half-round bastard file and put all the bevel on the inside to prevent binding. Cut teeth on the outside edge with a three-cornered file. In earth, move the pipe in a tight circle as you drive it, to provide for setting it in concrete. In hardpan or shale, keep it in one position. If it gets packed too solid to drive, lift it from the hole and knock or push out the dirt.—*Erik Miller, Sherman Oaks, Calif.*

Inner Tube Shields Surface

DRIVING a screw into a finished surface is risky without a protective shield. A slip of the screwdriver can mean an ugly scar. Try starting the screw into its pilot hole through a slit in a piece of inner tube. When one more turn will drive the screw tight, remove the rubber by stretching it up over the screw head.—*Ann Zawistowski, Coon Rapids, Minn.*



Improvised Adjusting Screw

WINGED adjusting screws on household appliances and some furniture pieces are often lost. A replacement can be made from a roundhead machine screw of a diameter to fit the tapped hole. A small



piece of scrap metal thick enough to fit snugly in the drive slot is soldered in place to permit tightening with the fingers.—*W. G. Waggoner, Sacramento, Calif.*



We Built a Back-Yard Trampoline

By Bob Gilmore

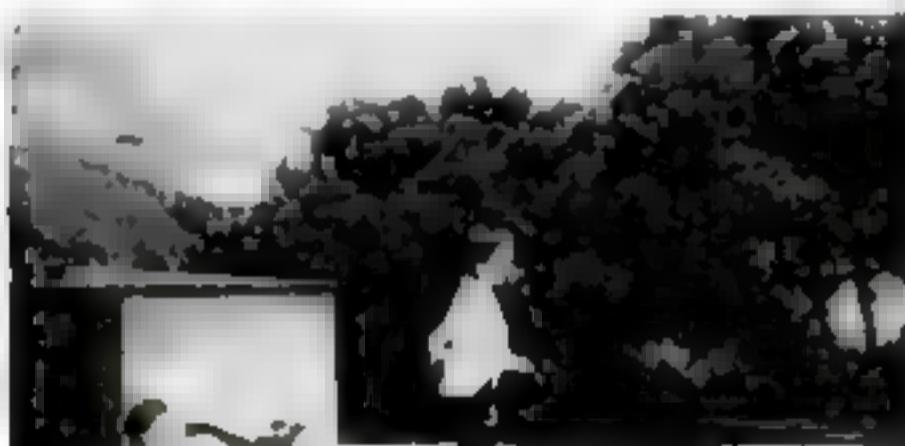
BOUNCING is the big news in sports this year. All across the country, public jump centers are popping up where you pay for the privilege of tumbling on contraptions that look like bedsprings but are actually highly engineered devices called trampolines. Youngsters—and many not so youngsters—are discovering the

CONTINUED

How the bounce craze is sweeping the country



THIS MINIATURE TRAMPOLINE combines all the thrills of diving with bouncing. It takes less space than a conventional diving board, is ideal where the pool-end area is narrow.



KID-SIZE BOUNCERS like this 4'-by-5' model can now be bought for as little as \$50, have a nylon-canvas net and a folding steel frame just like the big regulation trampolines.



PUBLIC JUMP CENTERS like this one in California are springing up all over the country. Nets are simply nylon webbing stretched across pits to eliminate costly above-ground frames.

10 rules for safe bouncing

1. Never permit bouncing unless supervised by a responsible person.
2. Get pointers from an expert if you don't know the fundamentals.
3. Don't allow horseplay, practical jokes, or wild jumps.
4. Forbid running or jumping to and from the net, insist on controlled step-ons and step-offs.
5. No jumping while the net is wet and

slippery from rain or dew, causing spills.

6. One jumper at a time for beginners; dual jumping for experts only.
7. Insist that jumpers keep to the center of the bed at all times.
8. Put a ceiling on high jumps until jumpers have mastered low bounces.
9. Call frequent rest periods—fatigue causes loss of control.
10. Wear loose clothing that guards knees and elbows against burns, and gym shoes or socks to protect toes.

thrills of doing flips, flops, twists, and tucks that challenge both ingenuity and muscle.

But the people who may be getting the biggest lift out of all this bouncing are the manufacturers of trampolines—once seen only in circus acts—and the enterprising operators who have turned vacant lots into gold mines by digging a dozen holes in the ground and covering them with nylon webbing. A fence, a flashy sign to advertise the place, and a shack to sell tickets and soft drinks are all that's needed. The investment seldom comes to more than \$10,000, and profits run to several thousand dollars a month.

Smaller, cheaper trampolines. Until the first public jump centers appeared not more than a few months ago in southern California, rebound tumbling, as the sport is called, was enjoyed only by school and club gymnastic teams, flight cadets seeking to improve coordination, and a few private individuals wealthy enough to afford an expensive toy. Now, with their fast-growing popularity, trampolines are appearing in many new forms.

You can buy a kid-size bouncer 5' by 7½', complete with frame, for as little as \$49.95. An even smaller dishpan size attaches to a diving platform to catapult you into a swimming pool.

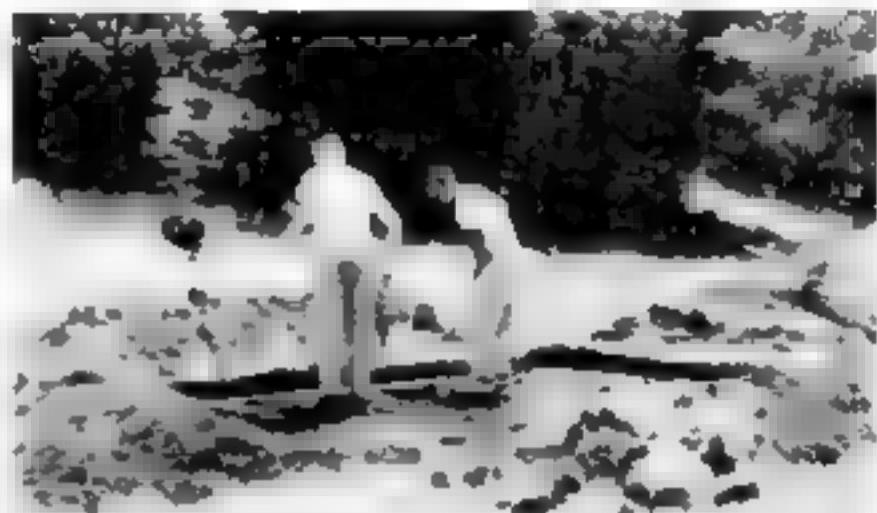
Still the sport is not cheap. Larger sizes up to 7' by 14' go as high as \$500 to \$1,000. Most of these have off-the-ground frames designed to fold up and roll away for storage. Some that don't fold are less expensive.

The new pit method, in which the trampoline is stretched across a hole in the ground, saves the cost of an elevated structure and is also becoming popular because of its greater safety—you can't fall off it. If you dig and frame the pit yourself, as we did, you can build a back-yard bouncer for considerably less than a store-bought unit.

You can buy the parts. We chose a mammoth 8'-by-12' size. Total cost came to \$480, about \$200 less than the same size bought ready-made. We also splurged on woven nylon, the most expensive net. This in itself cost \$269, but you can get a nylon canvas net in the same size for nearly \$100 less and a cotton canvas one for almost \$150 less.

Our size required 100 steel springs to support it at the edges. This added

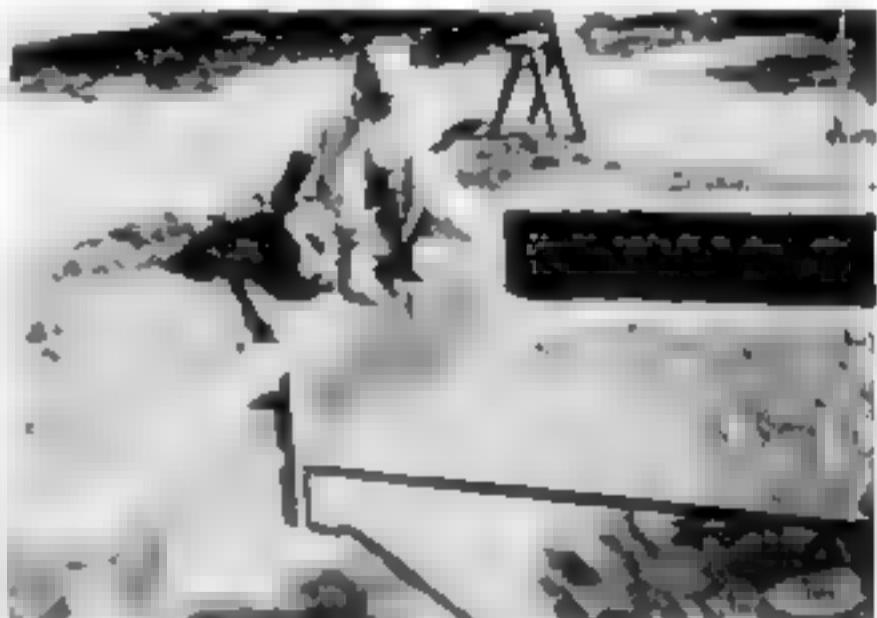
How we built our own trampoline in a hole in the back yard



STAKED-OUT STRINGS guide the start of the hole, laid out according to manufacturer's recommended frame size. Pit sides should slope to a minimum depth of 39" for a 6'-by-12' net.



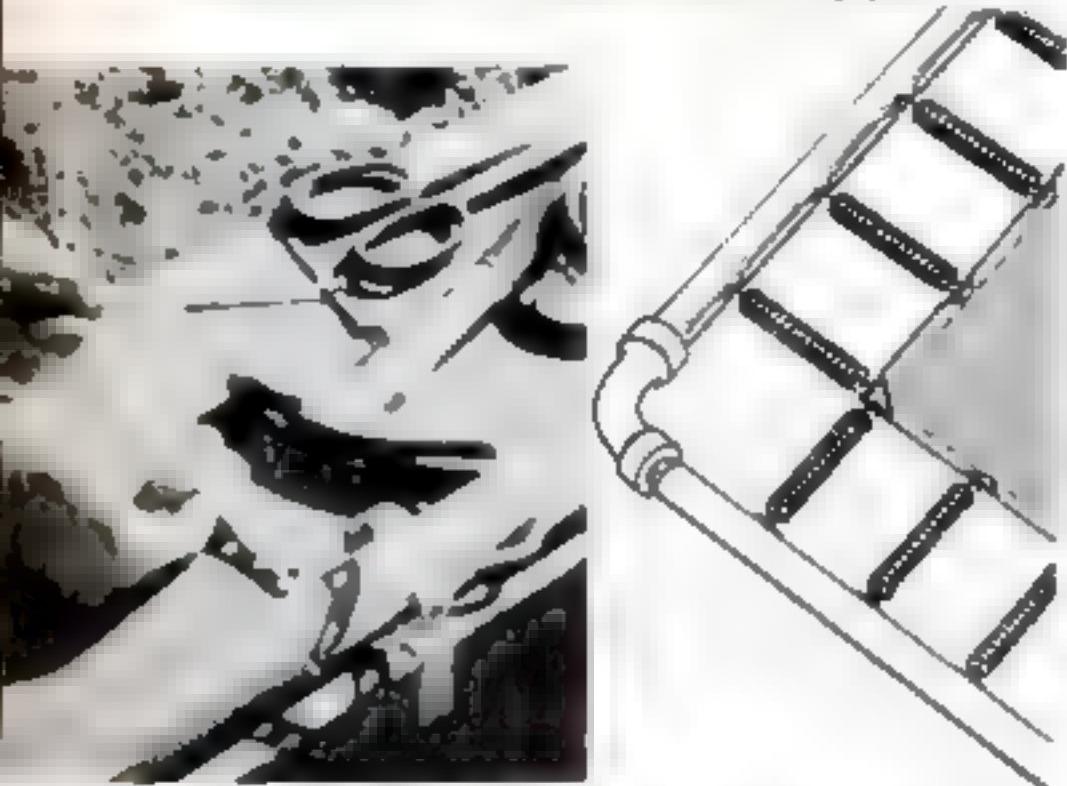
FOOT OF PIT is framed with 2"-by-12" redwood planks notched at the ends and half-lapped for strong joints. The lapped ends extend 12" beyond the frame to support 2"-by-12" rim planks. Planks rest on a shelf of earth at least 12" wide to provide a solid, non-caving footing. Temporary diagonal braces keep frame square while earth is backfilled up to the planks.



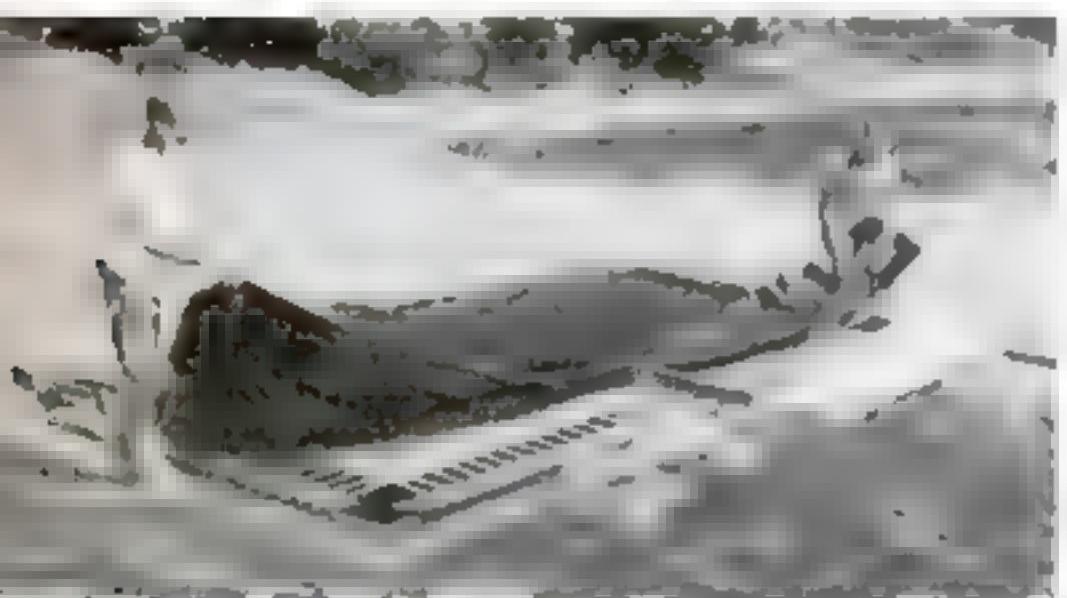
RIM PLANKS of 2"-by-12" redwood are nailed over lapped frame boards, locking them rigid. Brace, wedged across the middle, keeps sides from bowing in until top planks are on.



TO ANCHOR THE NET at the edges, a frame was made of 1" galvanized pipe. Loops to hold the trampoline's springs were then hammered into 1/4" rod and the rod was welded to the side of the pipe. To eliminate need for welding, heavy eyebolts could be run through the pipe.



PIPE FRAME is fastened to rim planks with strips of galvanized plumber's tape nailed on. We used five strips along each end, seven along each side. One corner of pipe frame must be welded closed or a pipe union used to avoid the problem of screwing the last joint together.



TO PROTECT THE NET and keep rain and animals out of the pit, we cover it with a sheet of black polyethylene when not in use. Pit should also have a drain pipe installed at the bottom.

another \$48. Protective pads to cover the edges of the frame cost \$60 to \$100. The only other expense was about \$63 for lumber to frame the pit and pipe to anchor the net at the sides.

It's not recommended that you attempt to make the trampoline net itself. These parts must be carefully designed for just the right amount of strength and springiness. There are many smaller sizes to choose from, however, and by selecting less costly materials you could make a pit tramp for as little as \$250. Health experts insist that the muscle-building, balance, and timing you gain are well worth the cost of the sport.

Use caution. Bouncing, like skiing, diving, or any fast-moving sport can cause accidents if you don't use common sense. A few jumpers at public centers have been injured as a result of careless falls or hazardous stunts. In contrast, years of properly supervised rebound tumbling in schools (even in schools for the blind and handicapped) show a record of amazingly few and minor injuries. The Nissen Trampoline Co., oldest in the business, reports no recorded injuries among family owners of their equipment.

We're not worrying because we've started with—and are insisting on strict adherence to—a set of safety rules for everyone who bounces. If you're not sure of the proper technique, it's best to get expert pointers first. Illustrated instructions can be obtained in a booklet called "Backyard Bouncing," available for \$1 from the Nissen Trampoline Co., 215 A Ave., N.W., Cedar Rapids, Iowa.

Where to get trampolines

The following manufacturers sell trampoline equipment.

American Trampoline Co., Jefferson, Iowa.

Fenner-Hamilton Co., 3200 S. Zuni St., Englewood, Colo.

Leflar Trampolines, 1426 S.W. Second Ave., Portland 1, Ore.

National Trampolin Co., 2600 Seventh Ave., Marion, Iowa.

Nissen Trampoline Co., 215 A Ave. N.W., Cedar Rapids, Iowa.

The Sampson Co., 7120 Remmet, Canoga Park, Calif.

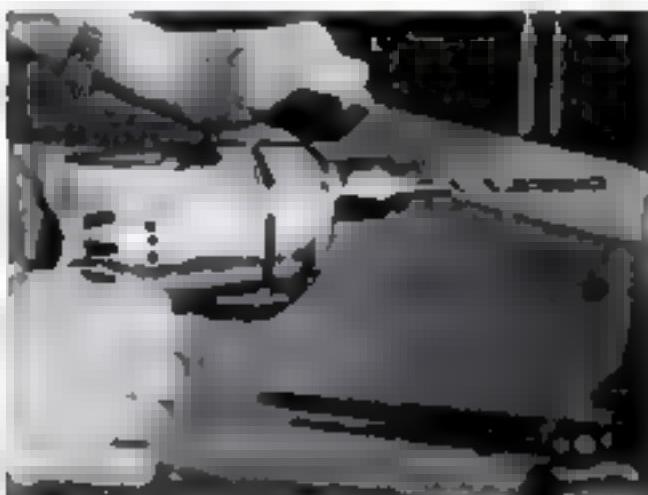
Sidlinger Products Co., Inc., 208-214 International Rd., Garland, Tex.



Photographed at Florida's Silver Springs



B&D's IMPROVED JO SAW gives 25% faster cutting, better control. Cuts straight, curved or intricate designs. Two extra blades free. Only \$29.95.



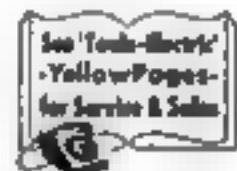
B&D's $\frac{1}{4}$ " DELUXE UTILITY DRILL packs a reserve of power to drive major attachments. B&D Drills from \$16.95. Attachments from \$9.95.

Less time for trimming- More time for living!

Give you ideas? Want to take the backache out of trimming? Have time for *living*? Well, why wait? Here's a truly professional Black & Decker Lawn Trimmer 'n' Edger at a homeowner price! Say "Goodbye!" to *all* hand work around trees, along walls and walks, on slopes. Take a look at B&D's Hedge Trimmers, too. Famous B&D power, handling ease and durability, of course.



For free power tool catalog,
write: The Black & Decker Mfg.
Co., Dept. E-080, Towson 4, Md.



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WORLD'S LARGEST MAKER OF PORTABLE ELECTRIC TOOLS

New Ideas in Photography



Automatic Projector Changes Slides 4 Ways

No glaring screen between slides

Here's an automatic slide projector that gives you a choice of four ways to change slides—and makes you a master showman with them all.

The Kodak Cavalcade Projector changes slides for you automatically at intervals of 4, 8, or 16 seconds . . . lets you change them by remote control . . . or by push-button . . . or by manual wheel.

You can put on a show at the pace you

want. Take as much time between slides as you need to explain them to guests. The Cavalcade Projector's controls let you hold slides, skip over some, repeat others—even on fully automatic. Between slides, there's no glaring screen. Slides change fast, too—no long dark period between them.

Ask your dealer to demonstrate all these superb features. Kodak Cavalcade Projector, Model S10, with 5-inch f/2.8 lens, \$159.50. Or as little as \$16 down at many dealers'.

Picture it now—see it again and again!

Compact Brownie Star Cameras Lead to New Trend in Low-Cost Picture-Taking

A few years ago, many people were content to go on using an old-type box or folding camera, no matter how bulky or heavy it was.

Then along came the modern Brownie Star Cameras—small, light, easy to use—to make picture-taking more fun and more convenient for millions.

Brownie Star Cameras are modern four ways. They're compact, palm-size. Easy to use: no focusing. Versatile: take snapshots and color slides. And two have a built-in electric eye to assure correct exposure every shot. Yet prices begin at only \$6.25! Go take a look—and see how modern a low-cost camera can be.



Brownie Starlet Camera, \$6.25



Brownie Starmite Camera, \$10.50



Brownie Starmeter Camera, \$19.95



Brownie Starmatic Camera, \$29.95

from Kodak

Missiles or Microbes: New Faster Color Movie Film Tracks Both Easily

Super-sensitive color motion-picture films recently introduced by Kodak are being used as powerful new data-collecting aids for science.

Known as Kodak Ektachrome ER Films, they are true and sharp enough to capture the faint changes in a missile's flame pattern . . . to permit microscopic movies of cell division and tissue culture without dangerous hot lights . . . and to help enlarge man's knowledge in many other fields where high-speed color photography has not been practical before.

The ER films have the same speed and fine grain as the sensational new Kodak High Speed Ektachrome Films, which permit 35mm photographers to shoot pictures they never could before, at indexes of 125 in artificial light, and an amazing 160 in daylight! They are part of Kodak's continuous search for finer films for every area of photography.

Meter in Kodak Electric-Eye Cameras Compensates for Too-Bright Sky

When you use an ordinary exposure meter, you must tilt it down to allow for sky brightness.

This isn't necessary with Kodak's new automatic electric-eye still cameras, because engineers have built the meter "tilt" right in! You just aim the camera directly at your subject, and shoot. The meter window (see diagram) diverts part of the sky light away from the sensitive photocell—compensating automatically for sky brightness!

This is why, with normal subjects, these cameras assure you correct exposure—"a good shot every shot." Let your Kodak dealer show you the automatic Brownie Starmatic Camera, only \$29.95; the Kodak Automatic 35 Camera, \$89.50. Look at the Kodak automatic movie cameras, too. These cameras will introduce you to the new automatic electric-eye era of photography.

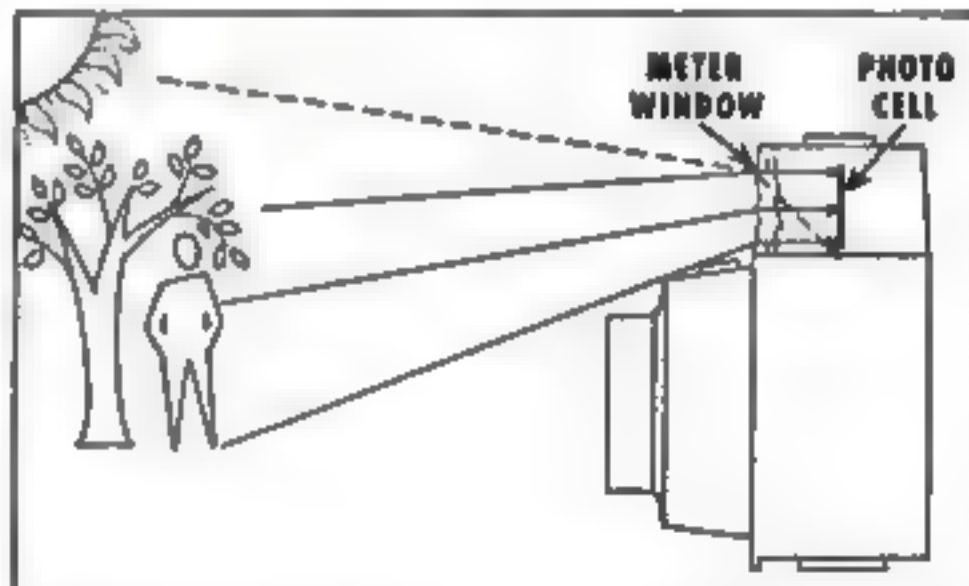
Prices are list, include Federal Tax, and are subject to change without notice.

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

SEE KODAK'S "ED SULLIVAN SHOW" AND "ADVENTURES OF THE NELSON FAMILY"



Extra speed of new Kodak Ektachrome ER Films permits scientists to record a missile's performance in both color and extreme slow-motion detail.



Electric eye of Kodak automatic camera measures light from subject, automatically diverts part of bright sky light to assure correct exposure.

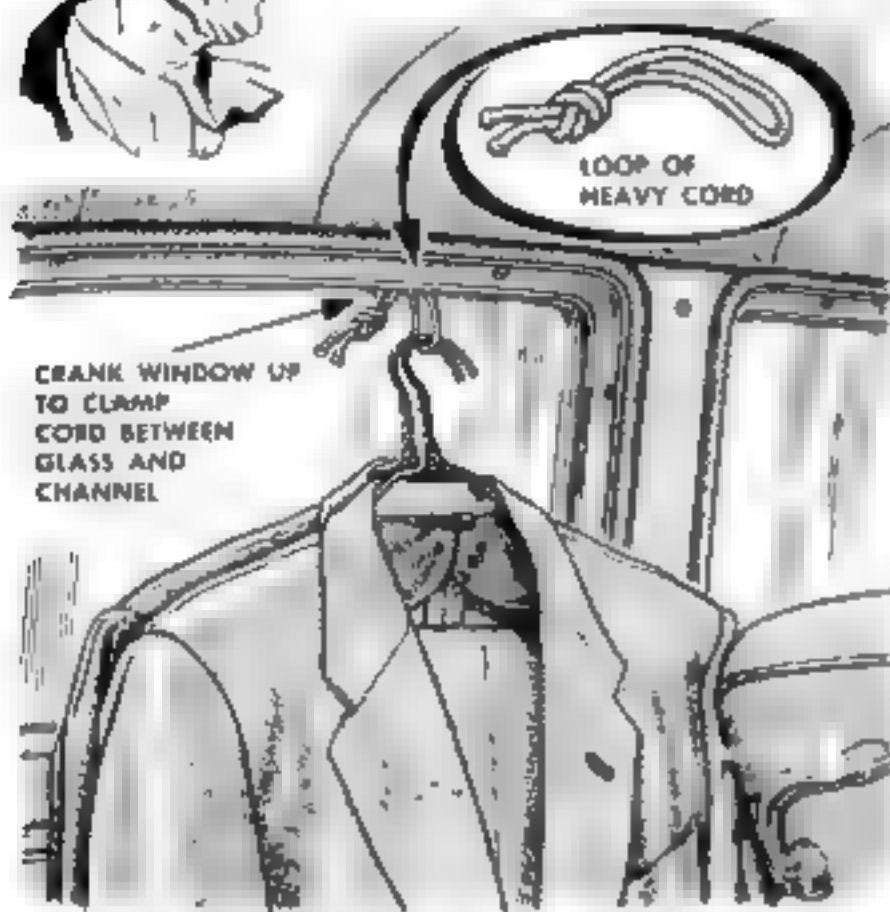
Kodak Automatic
35 Camera,
sets own lens,
\$89.50



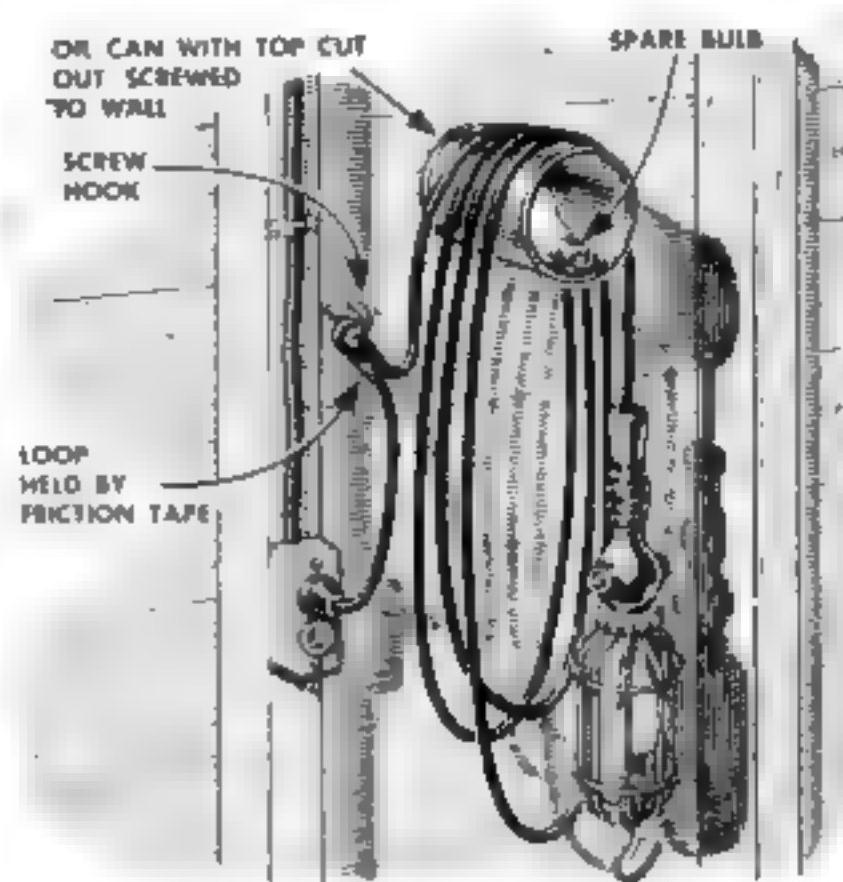
Kodak
TRADEMARK



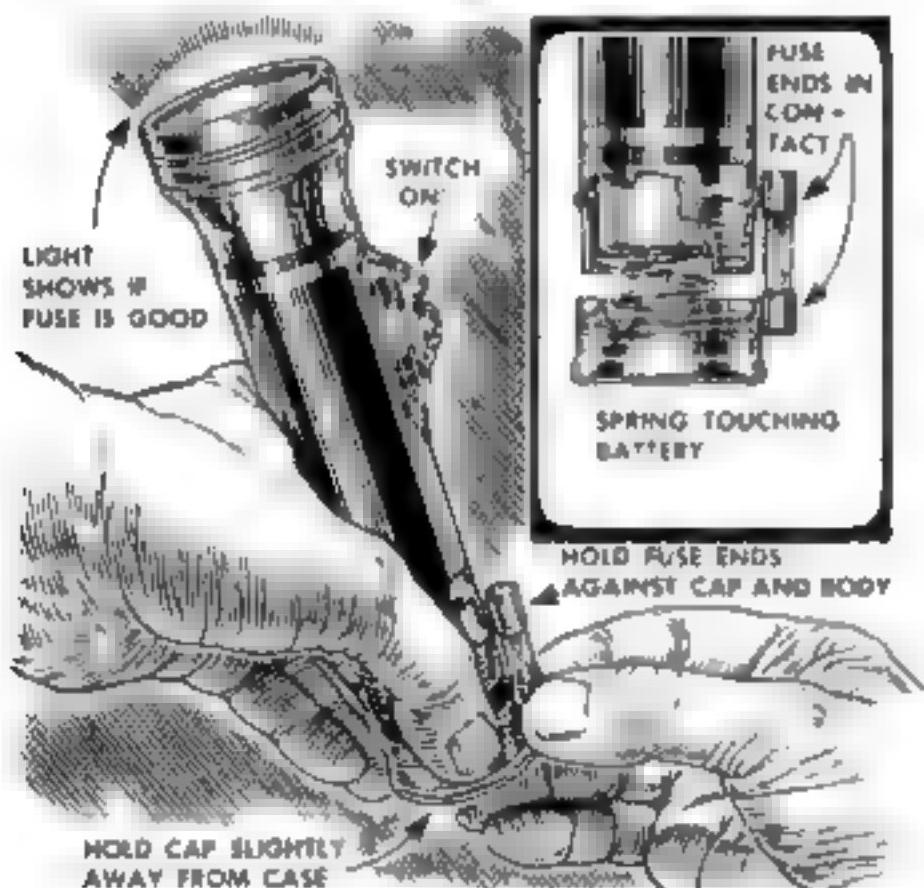
Hints from the Model Garage



A hanger hook can be improvised in an instant by catching a knotted loop of heavy cord between the top edge of a rear window and its channel. The loop will hold more hangers more securely than the metal hooks used in many cars.



Keep your trouble light trouble-free by coiling it loosely over a tin can nailed to the wall. The can will also hold a spare bulb. Form a loop near the end of the wire and hang it over a hook to keep from accidentally pulling the plug.



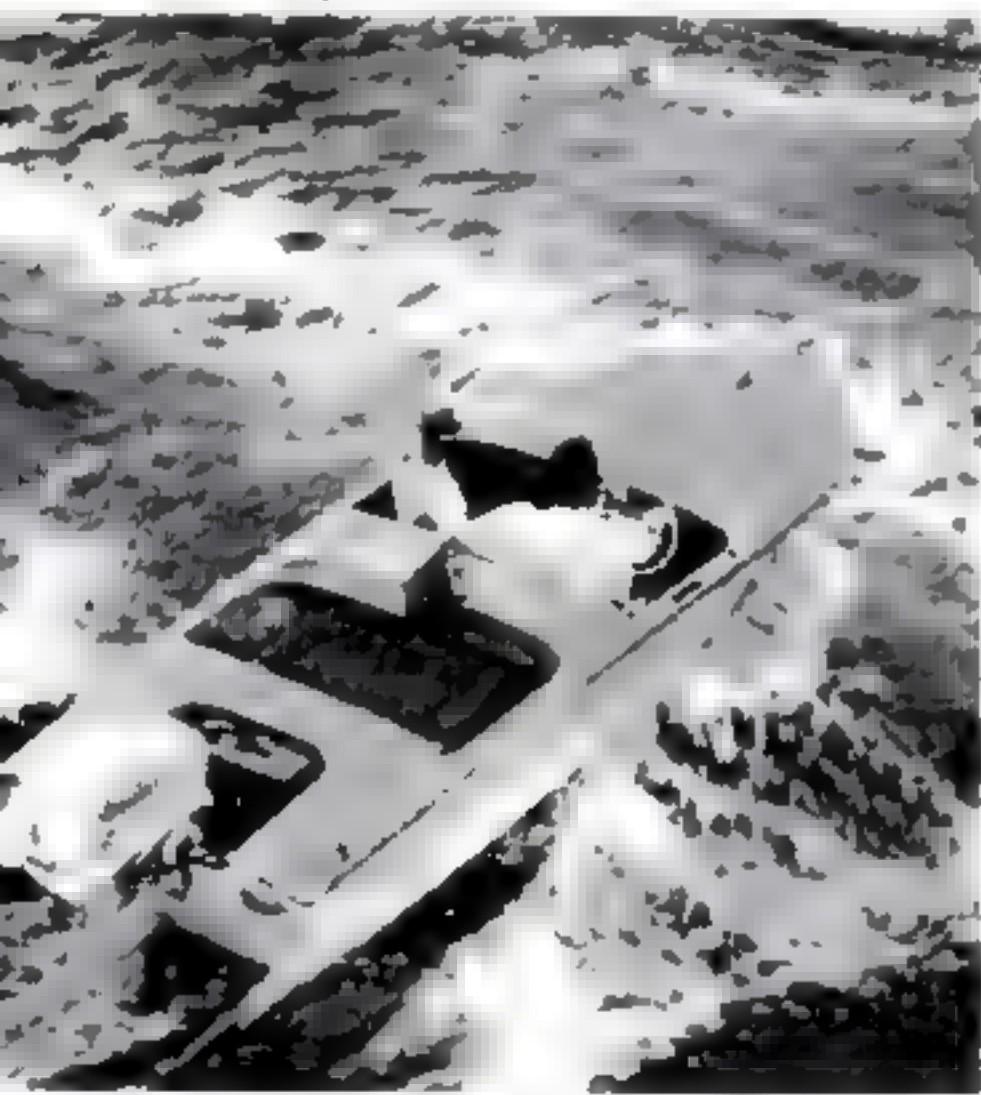
A quick test for car fuses can be made by unscrewing the bottom cap of a metal flashlight and separating it slightly from the body. With the switch on, a good fuse held so that it touches both cap and body will light the flashlight bulb.



Those little scuffs of color that appear on your car's bumper after close-quarters parking nudges can be removed easily without damaging the chrome. Dip a wad of steel wool in lacquer thinner and rub lightly until the marks disappear.



*Twice as many State Police cars
use Champions . . .*



*Every major U. S. outboard maker
uses Champions . . .*



*All U. S. fire engine manufacturers
use Champions . . .*



*Twice as many car manufacturers
use Champions.*

Q. Why do the experts, in field after field, where performance is vital, choose Champion spark plugs?

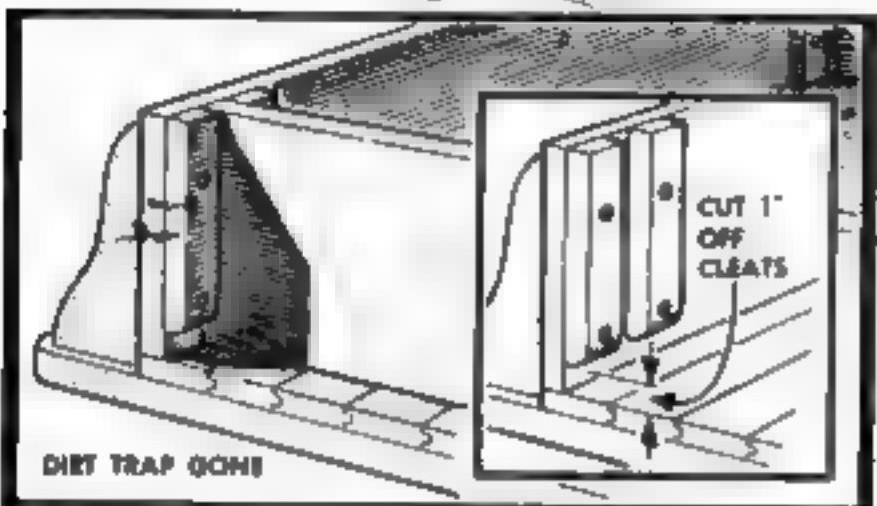
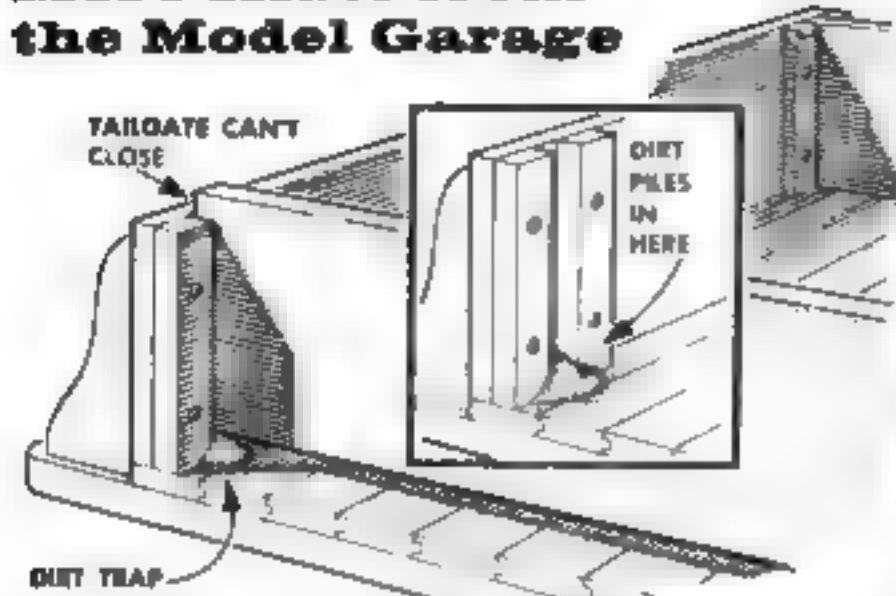
A. Because they know they can depend on Champions to deliver every bit of performance from every drop of gas. Your car will perform better, too (and save money on gasoline) with new Champions. Put in a set every 10,000 miles!

*Worn spark plugs waste lots of gas—
so check your plugs every 5,000 miles!*

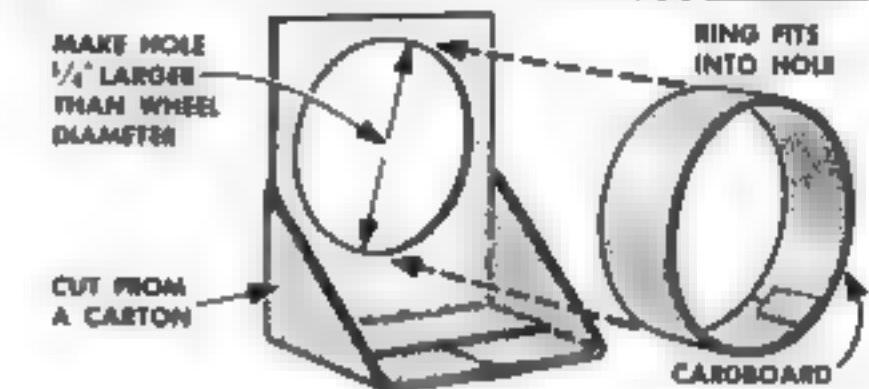
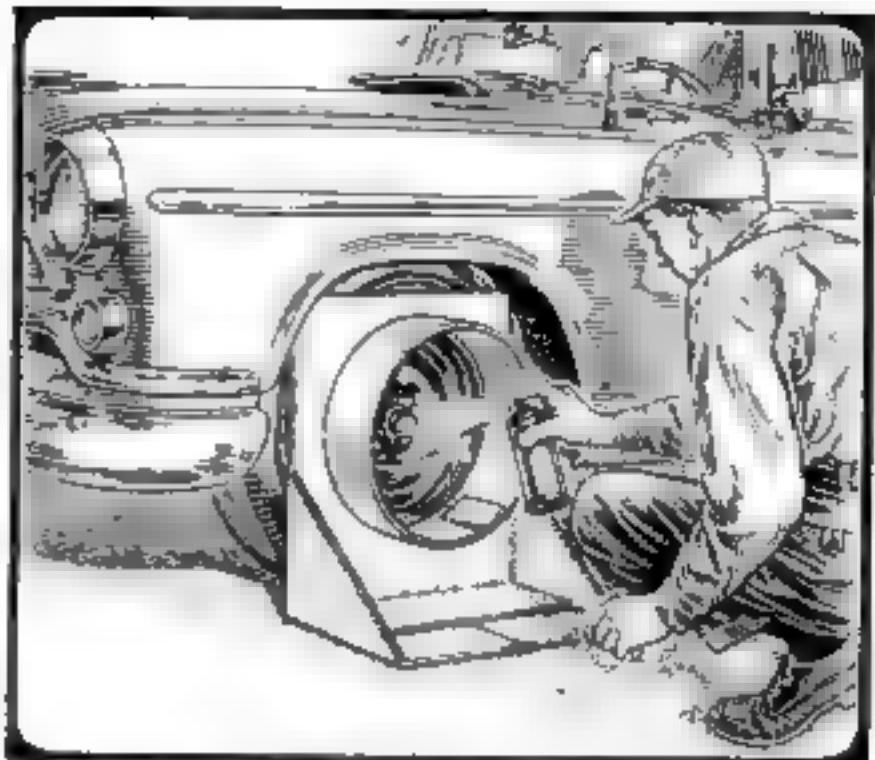
CHAMPION



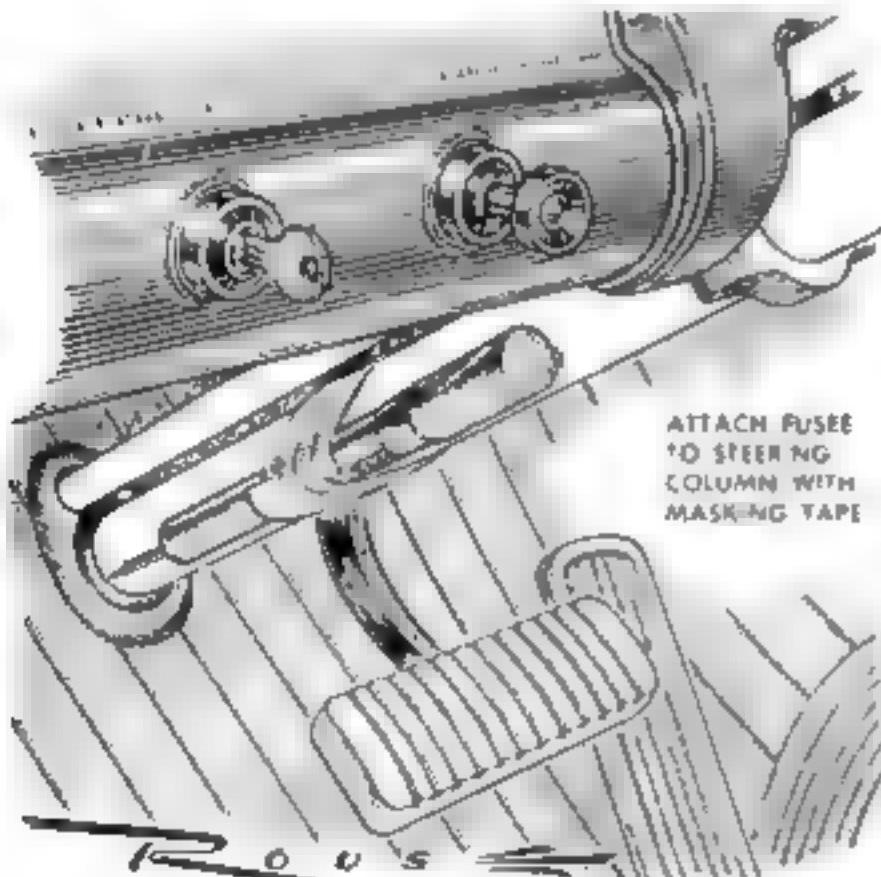
More Hints from the Model Garage



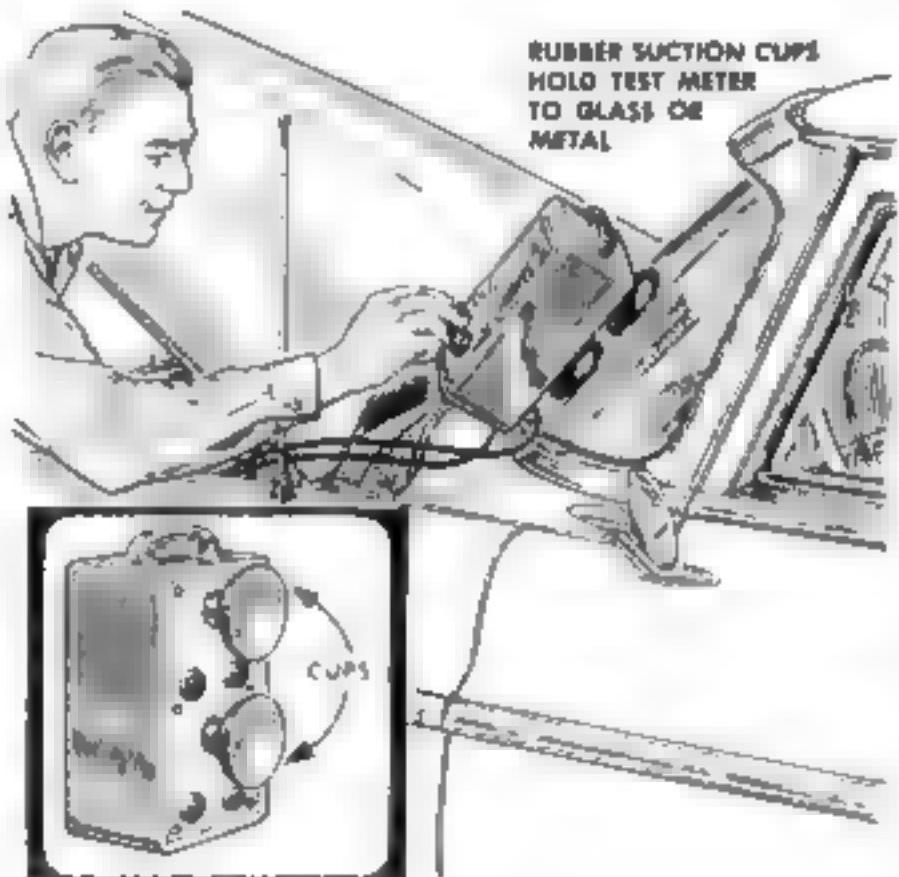
Dirt collecting in blind corners in the tailgate slots of a small truck or trailer often prevents the tailgate from closing fully. Eliminating these dirt traps is easy. Simply cut about 1" off the bottom of the tailgate cleats on each side



This re-usable mask will keep paint off the tires when you spray or touch up the wheels. Cut a carton as shown and stand it beside the wheel. Make a ring of cardboard and slide it through the hole until it bears firmly against the rim.



A truck fusee, besides warning oncoming motorists at night, will throw enough light to enable you to change a tire or make a minor roadside repair. Tape one or two to your car's steering post. A twist will break it loose when needed.



Anchor your test meter firmly in place with suction cups to prevent vibration from knocking it to the ground. You can buy rubber cups with nuts molded in them. Drill holes in the back of the meter case for bolts to hold the cups.

Tips from Weldwood—the people who know what's good for wood



Kill termites, prevent rot with
WELDWOOD WOOD PRESERVATIVE . . .



Add lasting color to outdoor wood with
WELDWOOD EXTERIOR STAINS . . .



Seal and prime outdoor wood with
WELDWOOD FIRZITE . . .



Protect and beautify outdoor wood with
WELDWOOD SPAR VARNISH . . .

WELDWOOD® WOOD PRESERVATIVE, essential where wood is in contact with earth, contains full 5% pentachlorophenol.

WELDWOOD EXTERIOR STAINS, 4 beautiful "woodsy" colors:

Redwood, Driftwood, Cascade Green, Sierra Brown.

WELDWOOD FIRZITE®, a penetrating resin-sealer for fir plywood, pine, etc. Comes in *Clear* to prevent "wild grain" in stain jobs; and in *White*, a pigmented prime coat to combat checking in paint jobs.

WELDWOOD SPAR VARNISH, durable, high gloss exterior clear finish that resists discoloring even in severe weather.



Gus Tangles with Lightning

By Martin Bunn

SULTRY still with yesterday's heat, the air seemed charged with tension as Gus Wilson unlocked the Model Garage. Remembering storm warnings the night before, he hoped there'd be no road calls.

At once the phone rang. Leaving Stan Hicks to unlock the pumps, Gus answered.

"It's Hal Durward, Gus. We're in a jam—need help right away."

Gus grinned wryly. Durward and his wife had moved to a remote lakeside house. A ride there would be a long one.

"The hospital won't send an ambulance because the baby isn't due, so I was going to bring Bessie in this morning. But the car won't start, and what the radio says has us scared."

"What's that?" asked Gus.

"Hurricane warning. Last big rain we had, this area was flooded. All the neighbors are gone. I had to break into a house to reach this phone."

"Take it easy," counseled Gus. "What's wrong with your car?"

"Lights and horn work, but the starter won't budge. Battery's too far gone. Hurry, Gus. I'm going back . . ."

The line clicked dead. Gus grunted in exasperation; he could have told Durward what to try, if the excited young husband had waited. Now there was nothing to do but get out there.

RATTLING down the dirt road to the lake, the heavy wrecker shuddered under wind gusts. Gus saw that driveways were empty, some houses shuttered. He braked to a fast stop before Durward's.

"Thank heaven you're here," the young man said. "Bessie's getting awfully anxious about being stranded with the baby near."

"You'll get out," Gus answered, and added a bit tartly, "Might be out by now, if you hadn't run off the phone so fast."

"No, the battery's dead. Look." Dur-



The wrecker was not as hot as the sedan and a slip to the ground meant electrocution





JUS-7333

REFUSE HAULER: Phillip Moreno, West Palm Beach, Fla. "In severe service such as this it takes Firestone Steelcord tires to do the job."

Here's owner proof of
Firestone truck tire
performance!

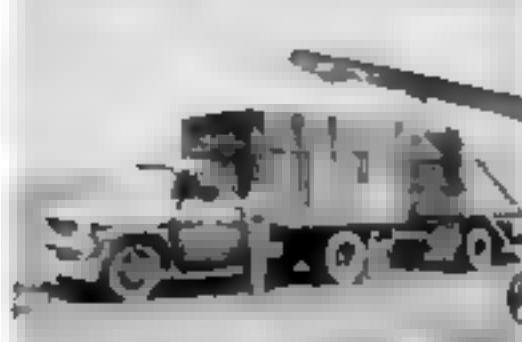
TOUGH TIRES STAND UP STRONG IN DAILY "MARCH" THROUGH LITTERED MARSH

Firestone

proved where profit depends on performance

A litter-laden, rubble-rooted marshland dump can throw new challenges at a tire's toughness every inch along the way. And every day, Firestone truck tires come up winners wherever the going's extra grueling! Firestones run 425 million test miles a year in proving the superiority of such famous extras as Shock-Fortified cord and Firestone Rubber-X, longest-wearing rubber ever used in Firestone truck tires. For low cost per mile, put tough Firestone tires to the test on your own truck soon. Get them at your Firestone Dealer or Store.

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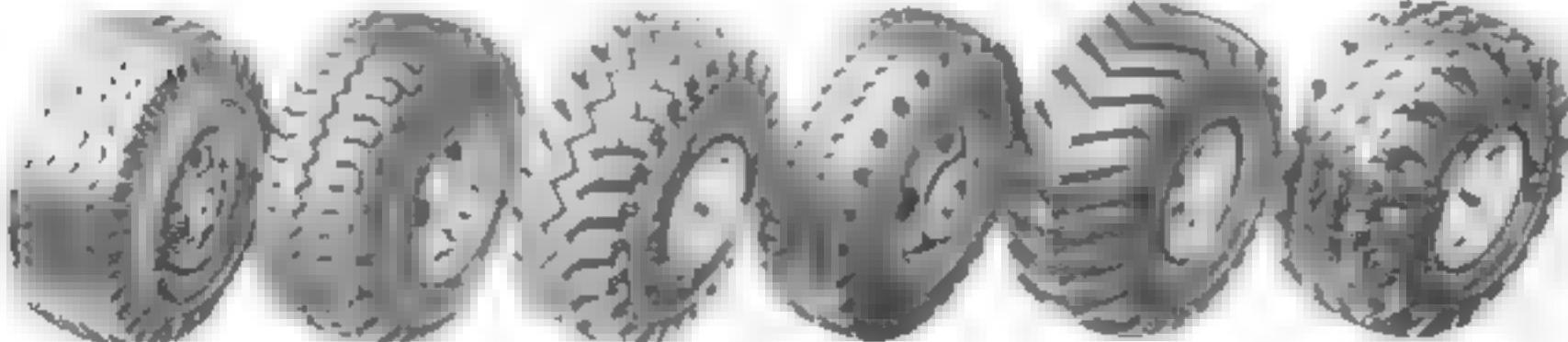
GRAIN HAULER: Otto Hannewald, Adrian, Michigan. "I like the extra traction Firestones give me in farm loading areas. I can't beat them for road mileage, either. I think they're the best tires built!"



AGGREGATE HAULER: Frank and Tony Scalise, Carnegie, Pennsylvania. "Firestones are the toughest tires we've put on trucks. Once you see how Firestones last you'll stay with them!"



HEATING CONTRACTOR: Howard Hughes, Memphis, Tennessee. "Hauling in and around construction areas used to ruin our tires before we got Firestones. I won't buy anything else now!"



Transport®

Super Maxxair Low®

Super All Traction®

Job Excavator®

Rock Grip Excavator®

All Traction®

*Firestone T.M.

ward leaped into the modest sedan, flipped the key over. A futile clicking of the starter solenoid was the only response.

"Just a second," said Gus, opening the hood. He scowled at the corrosion-en-crusted terminal clamps on the six-volt battery. Then with the hammer he was carrying he tapped both down smartly.

"Try it again," he ordered.

Durward turned the key. The starter growled for a couple of seconds. The engine fired and ran smoothly.

Durward climbed out with a pained look on his face. "What'd you do?"

"What I would have told you," said Gus. "Hammered the cable clamps down a bit. Overnight, corrosion worked into the joint, causing a high-resistance contact."

"But the lights worked!"

"Sure. Voltage drop is proportionate to the current. A poor connection may easily pass enough to work the lights. But it will drop the voltage way down when you try to pull a few hundred amps for the starter."

"Gee, Gus—I'm sorry. Guess I got panicky, trying to calm Bessie."

Gus chuckled. "They say young fathers get some of the wife's symptoms. Get going now. I won't leave till you do."

OCCASIONALLY the sedan vanished ahead of Gus on the winding, forest-lined road. Even in the solid cab of the tow truck, he could feel the force of gusts that whipped tree tops and hurled branches across the narrow asphalt strip. Nevertheless he put on enough speed to keep up with the car. The sedan was in plain sight when it happened.

With a crack heard even above the wind's howl, a tree on the right side of the road ahead of the other car began to topple. Gus saw a thin black line lash upward as the tree trunk fell toward the

road. Only then did Durward become aware of the danger.

The sedan's tires screeched. For a moment car and tree trunk seemed drawn together. A front wheel struck, the rear of the car slewed, and its fender settled against a rocky outcrop on the road shoulder. Simultaneously a black cord, silver tipped, dropped down across the car top and trunk.

Briefly the sedan shuddered in reverse. Wedged between tree trunk and rock, it did not move. The car door opened as Gus pulled alongside, horn blaring, to shout over the storm into Durward's startled face.

"Get back in. There's a wire on your car—maybe a hot one."

"I'm stuck. Pavement's dry—can't I get out and see what's holding me?"

"You'd make a better circuit than dry tires. Touch a foot down and you could be killed!" Gus roared. "Get back and stay—no matter what."

As if to punctuate his words, the rain began. Water pitchforked out of the wind-ripped sky, turning the road into a shallow river. Gus backed the wrecker and turned on its blinkers.

Rain water is a poor conductor of electricity, but in sluicing over a dirty car it becomes rich in minerals. Through the sedan's rear window Gus saw two frightened faces jerk about as miniature lightning flared from the cable's end. With thousands of amperes generating a magnetic field around it, the wire seemed to come alive.

It lashed about like a frantic snake, slid off the roof, again and again struck fire from other parts of the car, until it found a shiny bumper. There it glared fiercely for a moment, then subsided—arc-welded in place.

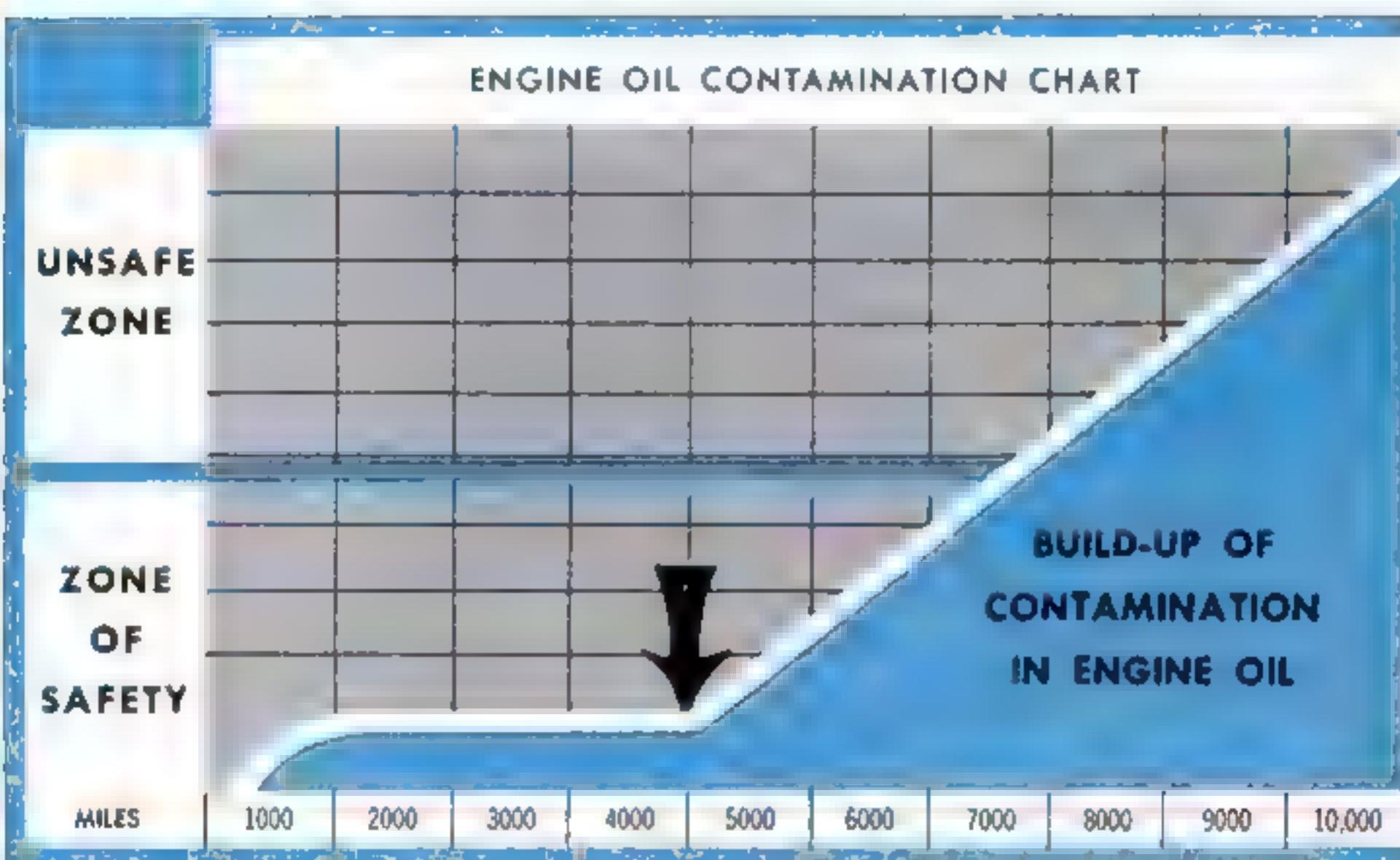
"The car's charged with juice," Gus shouted. "But you're okay inside."

Where'd it come from?



STADIUM: The popular sports arena gets its name from an old Greek measure—the stadium, originally meaning to stretch or span. The Greeks paced off foot distances in stadia—an Athenian stadium, for example, was about 607 feet. From this it came to represent a standard length for a foot race—and finally, the racing arena.

Look what happens when you forget to change your oil filter!



The oil filter in your car operates like a trap. It catches and holds dirt, dust and other contaminants that get in your oil. It's designed to hold the contaminants that collect in 5,000 miles of normal driving. The chart above shows you what happens when you forget to change your

filter. As you can see, the filter fills up and stops working. Dirty oil bypasses the filter and goes back into the engine where contaminants build up — fast. Be sure to replace your filter at 5,000 miles. When you do, be sure to get the best. Insist on an AC Triple-Trapper.

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"We could jump," yelled Durward, "so there'd be no contact."

Gus shook his head. "Your wife's in no condition for it. Besides, the road anywhere near the car is dangerous. Sit tight while I call the linemen."

The woman in the car shrieked. There was a scuffle inside. Then Durward reappeared, one arm tight around his wife. His face was pale.

"She tried to get out. She's hysterical. Don't know if I can hold her."

"You've got to. I can't even touch your car. But the utility company must be aware of this break. They'll soon have men here who can handle it."

Bessie Durward screamed, tore free



"Easy on the gas now, Mr. Pinckney."

from her husband. The right-hand door flew open. He pulled her back by main force.

"I can't keep fighting her, Gus. Do something!"

"I'll try," promised Gus.

In desperate haste he backed the wrecker, turned it and stopped to clamber back on the deck. There he freed the twin hoist chains. With a coarse file he scraped surface rust off one end of the big steel bumper apron.

BACKING cautiously toward the sedan, he angled in toward its left corner, held his breath as the wrecker's apron nudged hard against the car's bumper, and set the brake hard.

Again he climbed from the cab onto the deck, with the difference that the wrecker was now as hot as the sedan, and a

slip to the ground meant electrocution.

Hardly aware of the two who peered at him from behind the rain-washed car window, Gus lowered the hooks. Rain blurred his vision. Breathless from wind and tension, he finally engaged them under the edge of the car bumper.

Gingerly he engaged the power take-off, lifting the off-road side of the sedan first. Steel grated on chrome as the hooks settled to their task. The car lifted, rasped free of the rocks.

He was almost through the cab door when one foot slipped on rain-slick metal. For an age-long moment Gus hung by his hands, feet drawn up to avoid contact with the road. After pulling himself into the cab he was as wet with sweat as with rain.

Putting the wheel hard over toward the center of the road, he eased in the clutch. Slowly the sedan swung on its front wheels. Over his shoulder Gus watched the black snake draw taut. He fed gas to the engine. With an electric hiss the welded end tore free, struck out angrily. The wrecker groaned, eased the car away from the flailing wire.

Gus towed it several hundred feet, then stopped and climbed out, a bit shakily. Durward managed a smile.

"Head back for the turnoff," Gus shouted above the wind. "Take Route 60 to town. I'll wait to warn off other cars."

UTILITY linemen arrived 15 minutes later, along with a lull in the storm. Ted Carlson, the crew foreman, soon got the gist of what had happened.

"Twenty-four hundred volts on that line," Carlson said. "You were crazy to play around with it. You know the rules about any downed wire—assume it's hot, and leave it alone. All those people had to do was sit in the car and wait. We were on the way."

"Sure," said Gus. "So was something else—a little thing that made all the difference."

"Yeah? What could that be?"

"Biggest little thing in the world," said Gus. "A baby."

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crisp, clean beauty...and the new miracle resins are so durable they fight the effects of time and weather far longer! The result? A money-saving bonus of extra years between paint jobs!

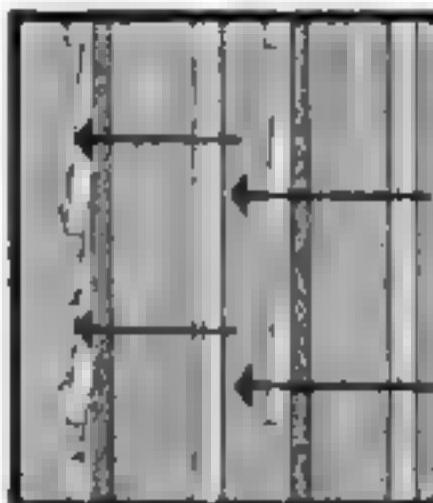
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Tricks for Driving Two-Lane Roads

[Continued from page 46]

The problem of passing drew these thoughts from another highly experienced driver—a man who has averaged 60,000 miles a year for decades:

"I know that a lot of pros who drive trucks, buses, and transporters get real near the car they are fixing to pass. They get so close they breathe down your rear-view mirror, and they try to hiss you over with their air brakes.

"Well, that may make sense for them, though I doubt it. Maybe it's because they don't have much acceleration, and because, sitting higher, they can see ahead better.

"My idea is that you gain a little and lose a lot by closing in on the bumper of the car you're going to pass. For one thing, you're in trouble on a quick stop. For another, your view of the road ahead is a darn sight poorer than it is if you lay back four or five car lengths.

"But the worst thing about passing from close up is that you are committed to longer exposure on the wrong side of the road. You pull out, hit the gas, and just hang there for seconds, waiting for your vehicle to pick up speed. If you've laid well back and have begun the pass from there, where you can see better, you will have gained decisive speed before you begin the wrong-side exposure. Better, there's still time and space to tuck back in if things don't seem promising.

"The only trouble with this, of course, is that some eager guy is likely to shoot up from behind and crowd into the space you've left. At that, he's not as dumb as the other Grade A jerk on two-lane roads: the stubborn fool who, when he sees a badly timed pass coming toward him, doesn't slow down to help out."

Misjudged passing was mentioned by all drivers interviewed, and several others suggested this trick outlined by one:

"For me the nightmare on two-lane roads is those terrible seconds after you are committed to a pass—and a totally unexpected oncoming car pops up from an invisible hollow down the road. It happens only on strange roads, of course, and it is a problem only when everybody is going pretty fast. But then it is pure nightmare. Years back, after a scare, I learned a trick. The moment I get out in the left lane where I can see way

down the road, I scan the fence posts and telegraph poles a few hundred yards ahead. If there's no dip in the way they march down the road, it's safe to commit myself to the pass."

Each of the experienced men interviewed listed some personal quirks and beliefs that he thought were important:

- "It's a little point, maybe, but whenever I come up to an intersection, I look first to the left, then the right, then back to recheck the left. The reason: You cross the path of anybody from the left before that of anyone from the right."

- "I make a point of keeping posted on what kind of a shoulder the road has. I want to know if it's hard or soft, wide or narrow, even or edged with a drop-off. Knowing this can save your life."

- "Just about the vaguest words on signs are 'Narrow Bridge.' You'll find them on everything from a 25-footer, where two semis can meet at 60 m.p.h. without sweat, down to rickety little jobs that can take only one Volkswagen at a time. The best thing is to expect the worst."

- "The dumbest thing you can do in passing is to let somebody else make your decisions for you. If the guy behind is real itchy, don't let him push you—pull over to the right and let him take his own chances. Same goes for the guy in front—if you try to tail along on his passing, sooner or later he'll tuck in fast and leave you out on the left with egg on your chin."

- "It's an old trick, but after dark on unfamiliar roads, I search for some local guy going my way, and whose driving habits I like. Once I've found him I get on low beam, maybe 150 yards back, and let him run interference for me. His tail lights tip me to curves, bridges, bumps, and any livestock or unlighted wagons on the road. Of course you've got to keep your wits about you, or you'll end up in his driveway."

- "The best prescription I know for driving two-lane roads is to keep your temper. Pass only when you can do it unspectacularly. Be your brother's keeper, but don't expect him to be yours. And try to make what are bound to be irritating situations—you are, after all, living in close quarters—a little more tolerable for everyone."

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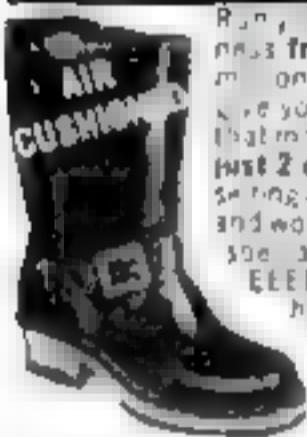
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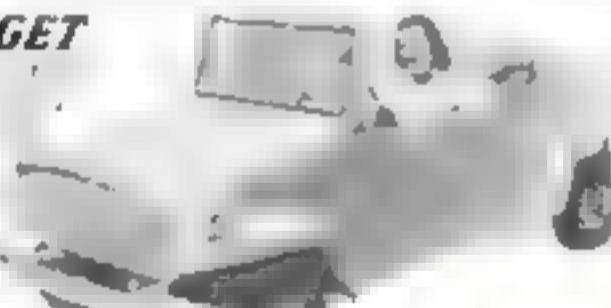
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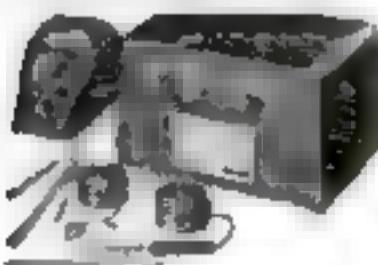


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The Case of the Blindfolded Dolphin

(Continued from page 73)

Norris explained. "We wouldn't give her anything to eat unless she let us touch her. She was fed from the rim of the tank, and our first big job was to get her to stay still while one of us cupped his hands over her eyes. She didn't like that at all, but she got used to it.

"Next, we put on gloves before we covered her eyes, figuring that they would feel more like blinders than our bare hands. It took a heck of a time to get her to submit to those gloves.

"But finally," Dr. Norris continued, "she was ready to be blindfolded. Unfortunately, we hadn't yet found out how to do it. We tried ear muffs on a headband. That was a great mistake. The headband came too close to her nostril—the blowhole—and she refused to breathe. We couldn't let her suffocate for science, so we gave up that approach."

The perfect solution, it turned out, was to cover her eyes with soft rubber suction cups. They worked the first time.

On the button. To test her sonar system, Dr. Norris and his colleagues had rigged up an underwater target consisting of a large button at the lower end of a slender rod. Before being blindfolded, Zippy had been taught to swim across the tank at the sound of a whistle and press her nose against this button. When she did so, a cord attached to the target arm rang a bell.

Now, with eye cups firmly in place, she was effectively blind and ready to be tested. Stealthily, to prevent the chance of her hearing him and being guided by her ears, Dr. Norris first moved the target to a new location. Then he blew his whistle.

Zippy charged forward, moving her blinded head from side to side as if she were signaling "No." Hydrophones recorded a storm of rusty-hinge sounds.

Though she was obviously searching with her sonar, there was hardly an instant's hesitation before she swam straight up to the target and gave it a bold, triumphant nudge.

Of course, like most scientific achievements, this had to be proved again and again. The target was made progressively smaller, until it was only an inch in diameter. Still, Zippy had no trouble finding it, even from 35 feet away. That was as

far away as she could be at the start of any hunt in the tank. And no matter how craftily the target was shifted, Zippy's sonar aim was unerring.

She and her human colleagues went on to demonstrate additional facts.

Dr. Norris was sure that a porpoise doesn't really need outer ears to hear with. He proved it by covering Zippy's little ear canals with foam-rubber suction cups. She navigated just as well with soundproof ear cups on as she did without. Sound reached her middle ear perfectly through blubber and muscle.

Directional beam. Finally, the collaborators demonstrated that the porpoise's sonar is directional. It emerges in a beam. Scientists used to believe that the rusty-hinge noises were manufactured in the animal's larynx and fanned out all over.

Not so. Dr. Norris found that when Zippy was hunting blindfolded, she couldn't find food that was dropped below the level of her snout, even when she was quite near it. Therefore, the sonar sounds couldn't be from her throat.

On the other hand, if the food were anywhere above her snout, her aim was precise. The sounds obviously stemmed from her forehead—from nasal sacs.

This assumption was proved with the aid of hydrophones. The rusty-hinge noises reached their greatest intensity just ahead of and above her snout.

With this clue, Dr. Norris and his co-workers fashioned a foam-rubber mask to fit over Zippy's snout and forehead. This would muffle her sonar transmissions, they reasoned, and should prove that without them she'd be helpless.

A mind of her own. Zippy reached the same conclusion. She absolutely refused to wear the mask. A few times, it was slipped on for an instant, but she always backed away and shook her head violently until the mask was brushed off.

After three months of trying, the experimenters gave up.

But Zippy wanted them to know that though nobody could make a fool of her, she was not one to bear a grudge. Each time she shook off the mask, she picked it up in her teeth and obligingly brought it back to her tormentors.

"Porpoises," says Dr. Norris admiringly, "really like people, bless 'em!"



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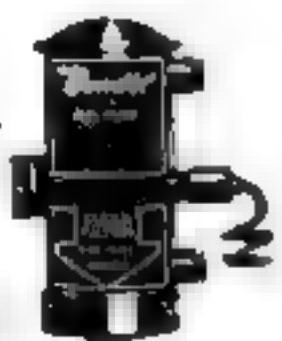
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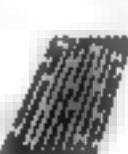
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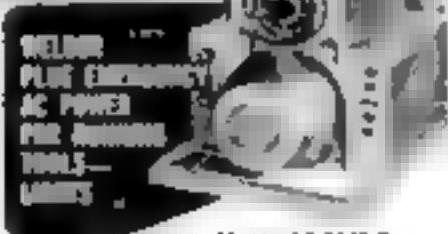
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Trouble: Pre-ignition knock and heavy oil consumption. Cause: Among other things, worn bearings! Note carbon deposits on piston head and dogged rings.

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But do it right. An overhaul that doesn't include new engine bearings just postpones the day when you'll need the job done over. Even new piston rings can't cope with extra oil throw-off of worn bearings—throw-off as much as 25 times normal!

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It's Tough to Buy a Car in Russia

[Continued from page 83]

door sedan has an advertised top speed of 115 kilometers (71½ miles) an hour. It is priced at 25,000 rubles, or \$2,500 at the tourist's ten-for-one exchange rate.

There is also a Moskvitch station wagon with a side-hinged rear door; it's about the size of the Simca Chatelaine, considerably smaller than a Falcon wagon. Another variation is the Moskvitch 410H, a sedan with four-wheel drive and extra-high road clearance for cross-country travel. Standard road clearance is generous by American standards—20 cm., or 7.87 inches. This model has 8.66 inches of clearance.

Classier and sassier is the Volga, new in 1957 and now being turned out in greater numbers than the Pobeda ever was. The Volga is a five-passenger, four-door sedan of the compact-car class, built on a 106.2-inch wheelbase (almost the same as the Valiant's).

It has a roomy, comfortable, and modestly smart interior. The front-seat back folds down to form a bed. As the car weighs just under 3,000 lb., its 80-hp. engine is lugging little more weight per horsepower (37.5 lb.) than the roughly comparable Opel and Peugeot (35.5 and 37 lb.). It is heavily loaded, though, by comparison with the Corvair (30.2 lb.), Falcon (26.6 lb.), and Valiant (27.2 lb.).

Nevertheless, the Volga has a top speed of 80 m.p.h., and is the dream car of many a would-be motorist. It will nick Ivan for 40,000 rubles if bought legally (the cheap way). To the American tourist, this is \$4,000. To Ivan, in terms of his earnings, it's far more.

Employed in a factory, for example, Ivan may earn 1,000 rubles a month (and this is an optimistic figure, the average being less). A new Volga will cost him 40 months' clear wages, which is on a par with a \$75-a-week worker here aspiring to a \$13,000 Cadillac Eldorado.

While Ivan is dreaming, he may as well go to one of the big-town industrial shows such as Moscow's 520-acre Exhibition of Economic Achievements and see the stunning Chaika (Sea Gull). A lot of automobile in any language, it rides on a 128-inch wheelbase, is powered by a 335.5-cu.-in. V-8 engine delivering 195 hp., and has pushbutton shifting, power steering, and electric windows.

It's Tough to Buy a Car in Russia

A seven-passenger, four-door sedan weighing over 4,000 lb., the Chaika is a heavily chromed luxury car. Factory specs say it will hit 160 km. (99.3 m.p.h.) and gulp 15 liters of gas per 100 kilometers. (This works out to less than 16 miles per gallon.) Needless to say, the Chaika is for official use and the favored few—scientists, writers, actors, ballet dancers—who can afford to buy it.

There are some bright spots in the car picture for the little man. If he's a war veteran, he can get any car for 10,000 rubles less than the regular price. If disabled, he may be given a "veteran's car" free. This is a little one-lunged three-wheeler, with a turtle-like body and a fabric top. It seats two, sells (when not provided free) at 4,700 rubles.

Once Ivan has his car, he faces a service problem. Gas stations offer no free air, oil change, or tire repairs. For these or for major work, you need a repair garage, and even around big cities there are only a few. Road help is almost nonexistent. Luckily, truck drivers are trained mechanics and will lend a hand for a few free-enterprise rubles.

For all Ivan's troubles, it's a mistake to underestimate Soviet industry. The Soviets are learning fast, and are buying automated as well as ordinary machinery from France, Germany, and other industrial nations. And though the U.S.S.R. turned out only about 125,000 cars last year, it built nearly three times that many trucks.

As more cars are built, Ivan's chance of owning one will slowly improve. Meanwhile, the Soviet Union claims it is selling vehicles to 35 foreign markets.

A car dealer in Syracuse, N. Y., recently got the sole license to sell the Moskvitch and Volga in this country. By the hocus-pocus of currency exchange and the Kremlin's eagerness for export markets, the tough little Moskvitch sedan sells here for \$1,555 P.O.E., the wagon for \$1,705, and the Volga for \$2,275; heaters are \$60 and \$70 extra respectively. You get a wide choice of colors.

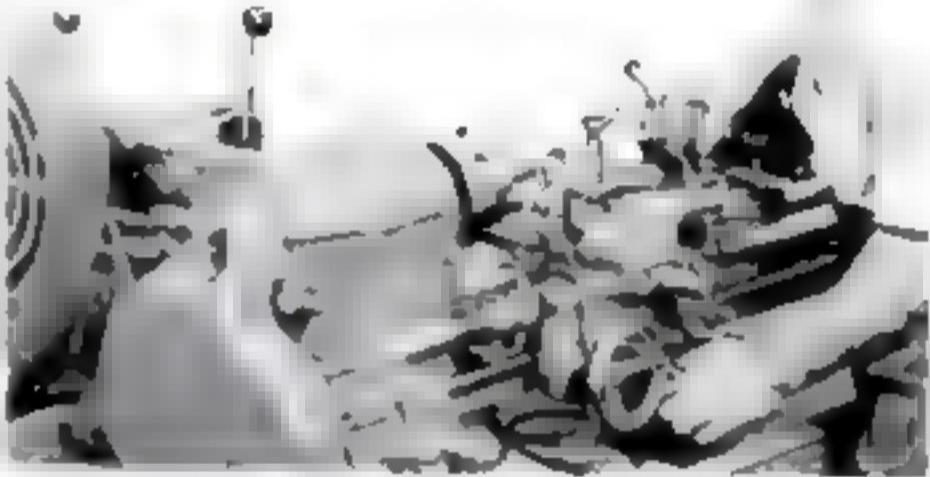
What does Ivan-on-the-street think of this? He's beefing. "Why," he asks, "does the U. S. have to buy our cars when they already have plenty? We need them more than they do." Truer words never came from behind the Iron Curtain.

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Do You Have a Hidden Allergy?

[Continued from page 89]

asthma is likely to persist and, even if it does subside spontaneously, may leave its victim permanently handicapped by lung complications.

How can offending allergens be determined?

Skin tests may show them up. The tests are made by putting powdered or liquid allergens on scratches or by injecting solutions of them into the skin. If an itching bump shows up in a few minutes, the test is positive.

Elimination diets often help. They start with a few basic foods, then add others until some addition triggers the allergy and thus can be recognized as the culprit.

Sometimes, not only a good deal of detective work but also a flash of inspiration is needed.

One young woman suffered attacks of dizziness that were traced to allergy to sweet potatoes. She stopped eating sweet potatoes. That should have stopped the attacks. It didn't. The doctor was stumped until he had a sudden hunch. She worked in an office. Did she ever lick stamps? Yes, she said. Stamp glue is made from sweet potatoes. Solution: a moistened sponge instead of licking.

Is there a cure for allergy?

No. But sometimes, when only one or a few allergens are involved and they're the kind that can be avoided, that's all it takes to forestall trouble.

When avoidance isn't possible, drugs may be used. They include antihistamines and cortisone-like hormones. Although they don't cure, they often provide relief. And they're useful when the actual cause of allergy can't be found.

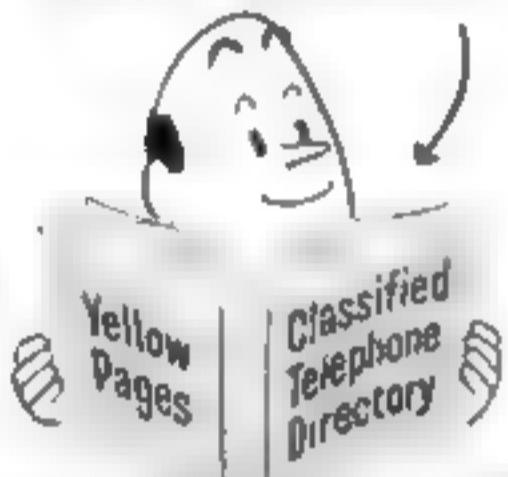
When the cause is known, desensitization often is effective. The idea is to inject the culprit substances, starting with very small amounts and working up, so as to build up tolerance.

Where are they getting with the one-shot treatment?

The wistful hope of hay-fever and other allergy victims has long been for a one-shot immunity treatment—a single injection that would protect them for a whole season, avoiding the 14 to 20 an-



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Do You Have a Hidden Allergy?

nual visits to the doctor now required for desensitization shots.

Today, such treatment is in sight.

For 20 years, Dr. Mary Loveless of Cornell University has been working to develop it. The idea is to put pollens and other allergens into a special carrier solution. This, after one injection, would release the materials slowly and evenly. It's tricky: Too quick release could provoke severe reaction.

But Dr. Loveless has reported success in hundreds of patients with ragweed.

dust, grass, and other inhalant sensitivities. And Dr. Ethan Allen Brown of Boston has used the Loveless idea in several thousand patients with reportedly excellent results.

You won't find many allergists employing the technique routinely yet. They want to go slow, make certain it is fully as safe and effective as multiple shots. But large-scale studies have been going on at several universities and, if they confirm the previous results, one-shot treatment soon may be commonplace.

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Coast to Coast in 80 Minutes

[Continued from page 77]

engines. Four do the trick. And we have them now: GE's 30,000-lb.-thrust J-93 and Pratt & Whitney's J-58. They won't need exotic fuels. They use kerosene.

To lick the critical drag problem, some designers want to make the fuselage a smooth, windowless tube. But pilots don't cotton to the idea. For plane watching, they prefer eyeballs to closed-circuit TV, especially in beehives like the pattern at Chicago's Midway airport. Passengers don't take to the blind tube, either; in every plane load, there's one grandmother from Moline who wants to "look out"—even at 70,000 feet.

A probable compromise: passenger windows, heavily beefed up against the incredible inside-outside pressure difference 13 miles up, and a pilot turret that retracts like a turtle's head at 2,000 m.p.h.

Inside, you can't tell the new liner from the old-fashioned 707. Conventional seats, usual hat rack, standard stewardesses.

But there are differences, big ones. All the seats are jammed as far forward as the manufacturer can get them, away from the hideous scream of the engines.

Like the old lady from Moline, you'll be able to look out, but the windows you'll look through are far from conventional. They are specially engineered to prevent the explosive decompression that would knock you out—from lack of oxygen—in a mere 13 seconds. This beast travels "out where space begins," so Lockheed recommends a double safety pane outside and another pane inside.

Between these panes is a baffle around which pumped air circulates. Not hot air to warm the glass, even though outside temperature will be 70 degrees below zero, but cold air to keep it from melting under the buffeting of the Mach 3 airstream. Without special cooling, both cabin walls and windows would rise to a hot-stove-lid 450 degrees.

Keeping cool. Ducts will carry cooling air through the double walls of the cabin to the baggage compartment, so your plastic suitcase won't melt, and to the wheel wells, so the tires won't blow up. Both North American and Lockheed like the Freon-vapor-cycle refrigerator.

Since aluminum tends to go soft at speeds above Mach 2.4, the supersonic airliner is all steel and titanium. And the

Coast to Coast in 80 Minutes

steel bulkheads and stringers are going to be costly to stick together, especially since the original production run—perhaps the only production run, since these planes will last "forever"—will probably not exceed 100 airplanes. Estimated cost of tool-up for a 250,000-lb. steel-titanium Mach 3 airplane with a production run of 100 airplanes: \$160,000,000. Initial cost per plane to the airline: a cool \$11,000,000—with sun visors extra.

Yet because of its incredible speed, the supersonic airliner's direct operating cost is five per cent less than that of the slow-boat subsonics. Hall Hibbard, Engineering VP at Lockheed, calls the Mach 3 "a real money-maker."

Taking off. The airliner is way over-powered for climb, and a good thing it is, for the fantastic rate of climb is the only thing that makes the Mach 3's four-engine scream tolerable. Because she gets so high so fast, most of the sound is dissipated by distance. In other words, the PNdb (Perceived Noise Decibel) level is expected to be always less than the 112 PNdb of present jetliners.

At 38,000 feet, so high that not even sonic booms can hurt, the pilot will shove the throttles forward and shoot on up to where the Mach 3 speed is comfortable. At 70,000 feet the sky above shades off into deep purple; you may even see stars in the daytime. The sunlight is intense and the shadows are an unearthly black.

Up front, the captain is busier than a bartender at a Russian vodka party, monitoring black boxes. Since there just will not be enough time for a human pilot to look at, comprehend, and react to conventional dials, much routine will be taken over by electronics: radio tuning, fuel scheduling, autopilot setting, and trim control.

A few minutes after you have hit cruise speed, the plane will start to nose down into the rough, humid air below, slowly and gingerly so as not to rattle dishes in every closet between Albuquerque and Los Angeles. Cleared into the pattern, you'll glide fast, 170 m.p.h., but come in over the fence at a normal 150, and roll to a red-hot stop well within the limits of today's 10,500-foot runway.



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Do Monorail Trains Make Sense?

[Continued from page 5.]

monorail is to use the Alweg design. Last May, the Century 21 Exposition entered into a preliminary agreement with Alvac International, Inc., for the line's construction; a final contract was to be signed in late July.

Those are the new monorails, the touted sky railways of the future. How good do they look? That depends on what you compare them with—and where.

Long-distance intercity monorails? These just don't make sense, Botzow finds. The track and its supports are bound to cost more, mile for mile, than the rails and ballast of a conventional surface line. True, a monorail can use a narrower right-of-way, costing less to acquire—but in open country where land is cheap, it will still be more expensive to build than a two-rail line. That seems to dispose of such daydreams of monorail men as a New York-to-Albany single-rail line, a 400-mile monorail in British Columbia, and one running the whole 108-mile length of Long Island.

Crowded cities offer the monorail its best opportunity. Traffic-clogged streets leave transit lines no place to go but down or up. Today the cost of subway-building has reached an almost prohibitive \$13,000,000 to \$16,000,000 a mile. Possible alternatives are two-rail elevated lines—or monorails.

So it's as an urban transit system, perhaps of 15 to 50 miles, that monorail is to be appraised. And it should be compared particularly with elevateds—of which new designs seek to avoid the din, the darkening of roofed-over streets, and the maze of traffic-obstructing pillars that were objectionable features of the old-fashioned Els.

First, a monorail line will cost less than an elevated to build. At \$2,000,000 to \$5,000,000 a mile, rolling stock included, it looks like a bargain.

One rail can squirm around sharper curves than two. A monorail train negotiates curves of only 100-foot radius, and takes 1,000-foot-radius curves at 60 m.p.h. "The advantages are far-reaching," Botzow says, "in by-passing expensive real estate, and in conforming to restrictive downtown street layouts."

As to safety, monorails score high. For one thing, it's virtually impossible

Do Monorail Trains Make Sense?
for a monorail car to jump the track.

The vaunted top speeds of monorails, surprisingly, have limited usefulness. In city-to-suburb service with closely spaced stops, 60 m.p.h. is about the most speed that can be used to advantage. Two-rail trains can reach that, too. To passengers, what really counts is average speed—depending largely on how rapidly a train can accelerate and decelerate. On that score, monorails rank with the most advanced of two-rail systems.

Single-rail lines closely match two-rail ones in passenger capacity, and in cost of operation and maintenance. And the pneumatic-tired monorail's noiselessness isn't exclusive with it. The Paris subway has been trying out pneumatic-tired wheels. Proposed new-style elevateds would have them, too.

But an outstanding point in the monorail's favor is that it blocks out less daylight. A modernized elevated, in proposed designs, resembles an elevated highway. It would be an improvement over old-type Els that cast a street in darkness, but it comes off a bad second to monorails in that respect.

All this makes a good case for monorails in general. Looking at particular ones, Botzow has reservations. Good points of monorail cars he's studied—safety, speed, light weight, spaciousness, comfort—haven't yet been ideally combined in any one design, he says.

And the monorail has unsolved problems. Gates to trains, now used at stations, hinder passengers—but riders must somehow be safeguarded against falling from platform to street. Still lacking is a switch for suspended lines, which must therefore have an endless loop of track. They also have the problem of limiting side-sway, especially in approaching a station, so as not to require an excessive gap between cars and platform.

Monorail lines are feasible for the future, Botzow's study concludes—but it will take further research and development to perfect a system for U.S. use. Eliminating the bugs will call for building "a prototype monorail that allows testing of loaded, full-size trains operating at intended design speeds." The planned Seattle line may be just the proving ground that monorail needs, to make its sponsors' visions come true.

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KITS

Henry Ford's Weird Old Engines

[Continued from page 67]

skimpy intake manifold and a single two-barrel carburetor further limited the engine. Ford had his engineers use as many stock parts from the then-current 239-cu.-in. flathead V-8 as possible. The crankshaft (slightly destroked), connecting rods, wrist pins, distributor, carburetor, and sundry other bits came from the production V-8. Ford liked to dream in metal and was willing to spend money to see his dreams come to life—but why spend it unnecessarily?

If Ford had pursued the overhead-cam V-8 further, a more exciting engine might well have developed.

At that, the experimental V-8 was no slouch. It displaced just 231 cu. in., eight less than the production L-head V-8, yet cranked out 117 hp.—compared with 85 hp. for the standard engine.

Two other offbeat V-type engines were built by Ford's experimental group during this same period. One was a wide-angle V-10, displacing about 300 cu. in., with a single overhead camshaft for each bank of five cylinders. Another was an air-cooled V-8 with deeply finned cylinder barrels—and overhead cams.

In his preference for either L-head or overhead-cam engines, Ford wouldn't have held with the rash of push-rod engines used today. This tied in with his passion for simplicity. Why introduce push rods and rocker arms when you can drive valve lifters directly off the cam-shaft?

The V-10 looked almost like an opposed engine because of the 144-degree angle between the banks. It seems to have been built to assay its possibilities for a future Lincoln or Zephyr. But impossible balancing problems doomed it.

Ford experimenters also spent a lot of time on honest-to-gosh opposed engines. They built perhaps a dozen opposed fours, sixes, and eights during the 1920s and 1930s. Most of these tied in with tractor or economy-car projects, although several were big enough to power the full-size cars of the day.

Despite Ford's aversion to in-line sixes, the experimental group turned out some engines of this type—most of them at the request of Edsel Ford, or because engineers cajoled reluctant permission from the old man to go ahead with projects

Henry Ford's Weird Old Engines
they felt might be competitively necessary.

The sixes were mostly conventional—although several used single overhead camshafts—and culminated in the flat-head in-line six that appeared immediately after the war.

More interesting was the in-line five-cylinder engine developed during the late 1930s and early 1940s. Ford apparently tabbed this as an economy-car engine. It was quite small, less than 150 cu. in. It gave engineers fits when the time came to balance it, but ultimately they managed a combination of crank-shaft counterweighting, firing sequence, and engine mounts that worked reasonably well. Dynamometer tests showed an output of some 50 or 60 hp.

As nearly as the story can be pieced together from material in the Ford Archives, the five-cylinder engine was one of several considered for a small car designed in the late stages of World War II. Two series of cars, Pacer (a name later used by Edsel) and Scout, were developed to the full-size-model stage. Both had 98-inch wheelbases and looked like an undernourished cross between post-war Fords and Mercurys. The cars were to weigh 2,000 lb. or less.

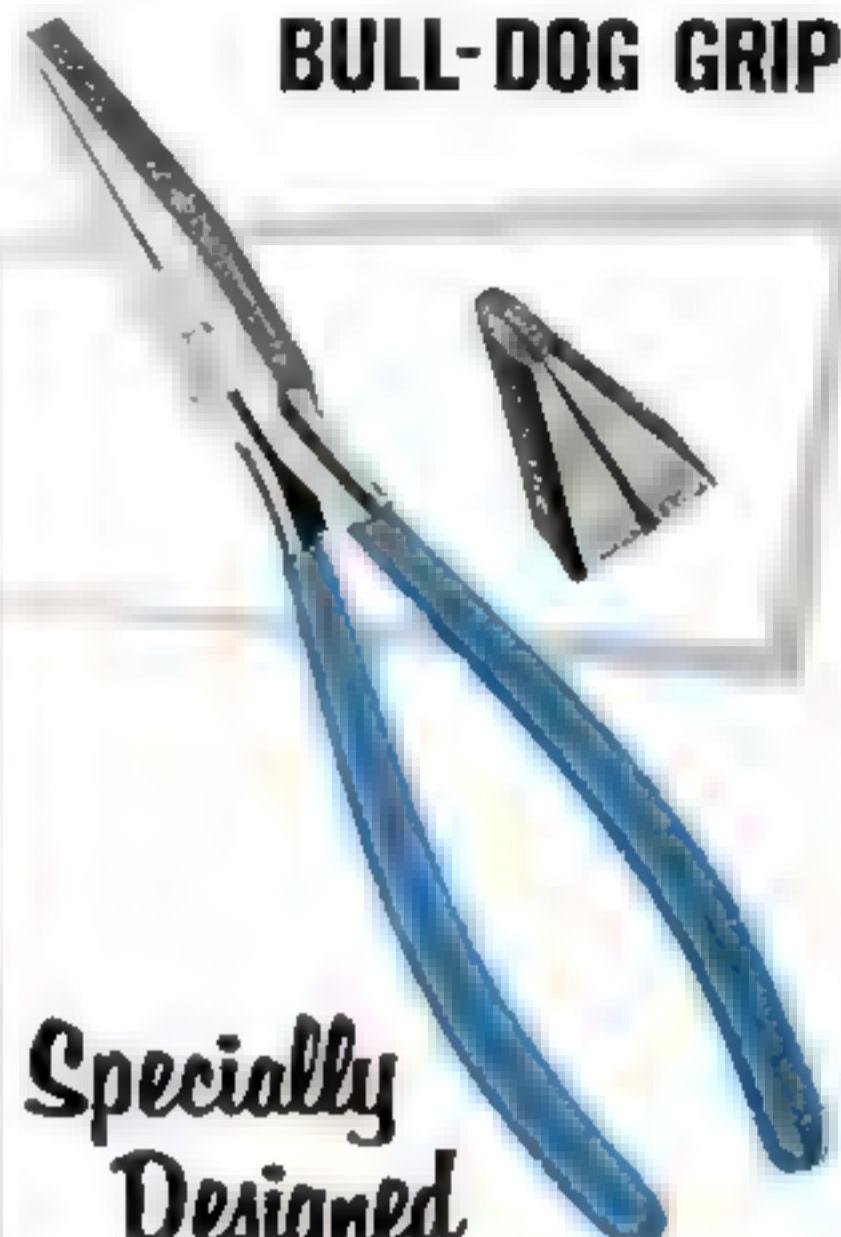
Economics doomed this and earlier sporadic Ford attempts to build a small economy car. Even the standard automobiles were pretty austere, compared with today's cars, during Henry Ford's life. It just wasn't possible to squeeze enough cost out by making the cars smaller so they could be priced attractively. As late as 1949, Ford built a full-size, operating prototype of a compact car with dimensions comparable (except in height) to today's Falcon.

Perhaps the weirdest experimental car Ford ever built wasn't powered by one of the odd-ball engines. To satisfy one of Henry's whims, engineers and mechanics turned the seats around in a Model A—so they faced backwards—and switched the steering gear so it turned the rear wheels. This, in effect, put the engine in the rear, but left it driving the front wheels. After watching this monstrosity navigate some 150 feet, nearly running into a building in the process, Ford ordered it broken up—"before it kills somebody."

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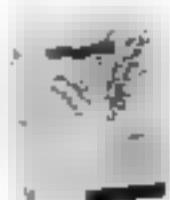
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Adventures with an Old-Time Engine

[Continued from page 149]

center. Ready to run, as I fondly thought, the engine still lacked a burner. It lulled me into overconfidence by accepting a lantern-wick holder as a perfect fit. I filled the tank and fired up.

Yanking over the flywheel drew the blobby flame into the port. It also caused a loud pop and a choked shriek from the whistle, and blew out the flame. Five minutes and two matchbooks later, I tried resetting the valve timing.

That pesky whistle. Worse than useless, this last dodge left me wondering what I knew about vacuum engines—and why the whistle had that ball valve under it. There could be only one answer: to evacuate gases left at the end of each working stroke. Overlooking the obvious fact that the whistle must have had a lock nut on it originally, I had turned it in too far, limiting ball lift or blocking the vent. Unable to get out in a hurry, the trapped gases popped open the port valve and blew out the lamp!

After backing off the whistle and adding a lock nut, I relighted the wick and whipped the flywheel around. It promptly bucked to a standstill. My experiments with valve timing had left it very late. I reset the cam.

The flame blew out—this time for the good reason that it was out of fuel. I filled the tank, lit up.

Already hot, the engine galloped into action with an ear-splitting shriek that was sheer music. Never have I enjoyed a racket so much. gingerly I tested torque by hand (two determined fingers on the $\frac{1}{4}$ " shaft could just pinch it to a stop). A tachometer showed top speed to be only 400 r.p.m., but every revolution was an ear-drumming delight.

When fuel ran out, I let the engine cool, and then began to clean it for refinishing. That old-timer wasn't through with me yet. As I lovingly cleaned the nameplate with solvent, half the irreplaceable lettering came off.

With that to put me in my place, I still have a museum piece all my own, one that runs with a heady reek of alcohol and the metallic hot smell of a working engine. Brought back from a junkyard grave to utter its shrieks again, it's more than a whole museum full of motionless ghosts.

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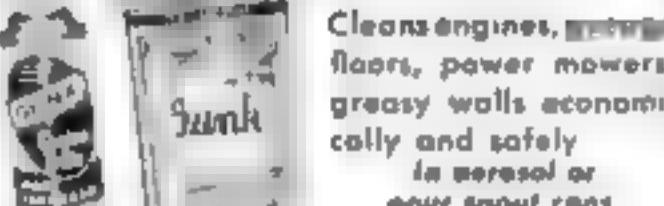
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Answers to PS Puzzlers on 18 and 20

The mixed-up check. The amount is \$14.32. First change everything to cents. Then if $x =$ the number of dollars and $y =$ the number of cents, the value of the original check in cents is $100x + y$. The clerk's error turns that into $100y + x$. In equation terms:

$$100y + x - 350 = 2(100x + y)$$

Too many unknowns? Solve for y .

$$y = 350 + 199x$$

$$\begin{array}{r} 98 \\ \times 98 \\ \hline 98 \end{array}$$

And look at the fractions as mixed numbers

$$y = 3\frac{4}{7} + (2\frac{3}{98})x$$

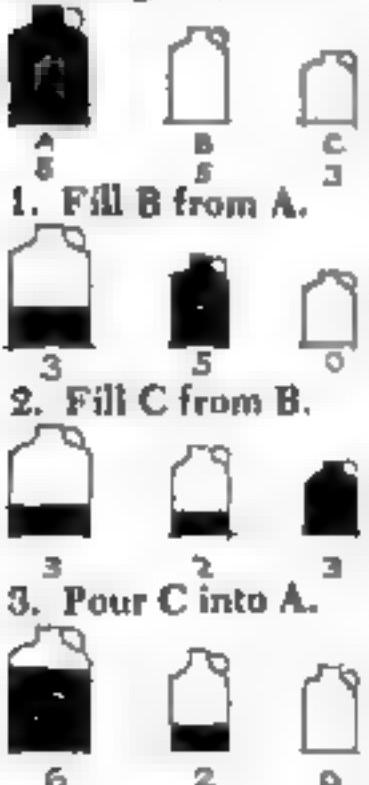
The trick is that both x and y have to be whole numbers, so whatever you substitute for x has to yield a whole number for y . The light begins to dawn when you observe that 98 is divisible by 7 and 14. Mentally trying a few such choices for x and seeing what you get for y soon shows the only solution:

$$\text{Let } x = 14. \text{ Then } y = 3\frac{4}{7} + 28\frac{3}{7} = 32.$$

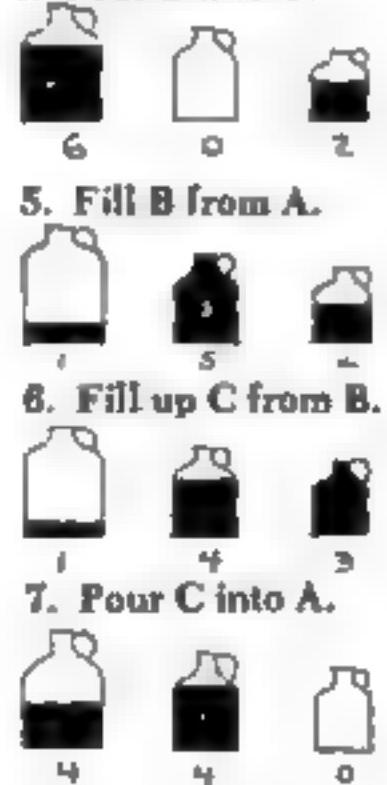
Inn. What happened to the second man?

Pagoda. The Japanese are making use of the principle of inertia to keep the pagoda from toppling over in an earthquake. In a quake, the foundation moves laterally. The lateral force is transmitted upward through the walls to the pagoda's roof, where the pendulum rod is attached. Due to inertia, however, the ball at the end of the rod tends to remain stationary, and thus resists the roof's movement. (Actually, it moves slowly after motion has been communicated to it.) And the building stays upright.

Sharing the wine.



4. Pour B into C.



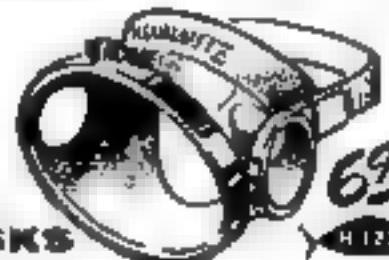
Bees. There are 72 in the swarm. The algebraic equation is simple to write:

$$\sqrt{\frac{1}{2}}x + \frac{8}{9}x + 2 = x$$

But it's messy to solve. However, you know the number you're after is 2 times a perfect square, and is also divisible by 9. Thus, 72 (36×2) comes to mind pretty fast.

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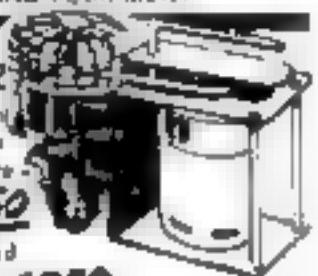
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Can You Build the Right Campfire?

(Continued from page 131)

from a fire, set it on sticks or a piece of bark, not on the ground. The earth will quickly draw heat from a pot.

How to stay warm all night. An Indian fire is good for nights that are cool, but not icy cold. Trim eight slow burning hardwood saplings about 6" thick at the butts. Lay four of them in the form of a cross, butts together, and at the center build a small, hot starting fire. When this is going well, lay on the other four saplings, arranging them between the first four like spokes of a wheel.

As the logs burn away during the night, keep pushing them in toward the center. With your back to a windbreak such as a cliff, you'll be comfortable all night, and in the morning you'll have hot coals ready for breakfast.

Use a reflector in freezing cold. When the temperature really goes down, a reflector will direct heat toward you. The fire itself is basically the regular log-cabin type flanked by two logs about 18" apart to cut down the draft so the fire will burn slowly.

If you can build your fire in front of a cliff, large boulder, or earth bank, you'll have a natural reflector. If not, you can make one by driving three pointed saplings into the ground at an angle. Locate them about 2' apart on the side of the fire opposite your sleeping quarters.

Against these slanted poles build up a row of logs to form the reflector. Use only green wood so it won't burn. If there are plenty of flat rocks around, add a facing of these over the logs and you'll have a better reflector. With enough fuel to last the night, you can stay warm even in freezing weather.

Starting a fire in the rain. Build up a platform of sticks across two logs to keep your foundation fire off wet ground. Try to locate it under a fallen tree or rock shelf to shed rain. A dead softwood tree leaning to the south is also good. Its bark and wood on the underside will usually be dry and can be chopped off and burned.

When gathering wood in wet or snowy weather, pick dead branches still on trees, which are usually dry. If you can't find any dry kindling, place a candle—a camping essential—in the center of the foundation cone.

Here Comes 8-Ball Racing

[Continued from page 153]

smooth faces toward the panel, on 8-32 bolts. If they fit loosely, wind plastic tape on the bolts to a close but free-turning fit.

Swing-link pivots are flat-head rivets pressed into tight holes in the panel. Fold tin plate lengthwise for the trip bar, bending one end square for the trip pin, a $\frac{3}{4}$ " nail. Hang the bar on rivets soldered to the links.

For the pawls, cut $\frac{1}{4}$ "-by-1" bits of spring bronze tapering to $\frac{1}{8}$ ", solder bits of rod to the ends and round them smoothly. Solder one pawl to the trip bar. Slot the other for mounting adjustably with a bolt.

Drive in small pins as stops to let the trip bar advance the ratchet disk only one hole at a time. Adjust the other pawl to drop into a hole at the end of this movement, preventing reversal.

Make light platforms of thin aluminum. Punch the pivot holes and trip slot, turning the edges in. A thin bicycle spoke makes a good pivot shaft.

Bend one end of a bobby pin 90 degrees to engage a notch filed in the lower trip-bar stud. Spring tension should lift the platform and return the trip bar against its upper stop.

Assemble the flag mechanism on a block. Drive an escutcheon pin between two ratchet holes, letting it project $\frac{1}{4}$ ". Clamp the flag block to the panel where the pin best trips the trigger. Then drill for a mounting bolt, which serves as a stop for the flag lever.

Trace lap numbers on a cardboard ring. Slot the wood base to clear the ring, and cement it to the ratchet disk so that the flag pops up at 15. Make a cover plate with a notch that exposes the top number. Weight the cars with old flashlight cells or washers until they trip the counters reliably.

Racing rules. If a car is hit and heads for its pylon, slackening its tether, try backing to pull the tether taut and get back on course. If a driver cannot do this without handling the car, he must call for time out.

He then places the car where it first spun in, while his opponent must stop and return his car to the forward end of his lap counter. The race then goes on from these positions.

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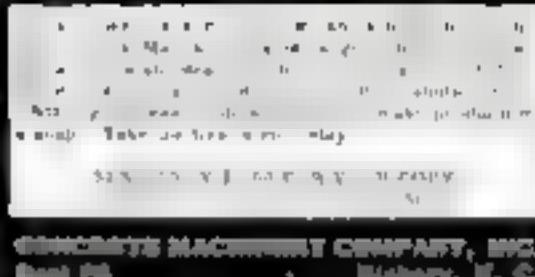


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How I Got Hooked by Kite Fishing

[Continued from page 140]

feet off shore in a minute or two and drop it where you want it with a fast but short reel-out.

Standing at the water's edge or in the shallows, you can overweight your lure slightly and use your kite for towing to troll it outward with your reel lightly braked. When you're ready to troll shoreward, you reel in.

Yolen adjusts the weight on small kite lines by the quarter-ounce, on larger ones by the half-ounce or more. Once the weight balance is set, a simple rule governs the height control of your lure: Reel out fast (or drop your rod) to drop your lure; reel in or lift your rod to lift your lure.

When you get a bite. Except in very gusty weather you can feel a bite on a kite line just as you can in ordinary fishing. But you have to play the big ones carefully. Your line is held at both ends, and a sideward pull by a game fish can boost the load on the line. You stand to lose both fish and kite.

If you're mostly interested in a fish dinner, you can aim your aerial attack at pan-sized catch. In lake country, the most spectacular results are likely in summer when fish move out to deep water beyond the reach of dock fishermen. With a gentle offshore breeze, a fair-sized kite will quickly carry your lure or bait far beyond the range of the best cast.

Kite size. Plan your kite-fishing line, rod, and lures around the fish you expect to get. Then use a kite that can carry the line and the lure. For two- to four-pound fish, you'll need a little over $1\frac{1}{2}$ square feet of kite surface. (The average small toy-store kite is close enough.) The heavier (and usually much longer) line needed to bring in 7- to 10-pounders, and up, calls for about a square yard of kite.

A straight offshore breeze gives you the greatest outward range, but any offshore angle will do the trick. From the end of a pier or breakwater you can even do your kite fishing in a breeze that parallels the shore, and still enjoy the greatest range and flexibility of anybody on the spot.

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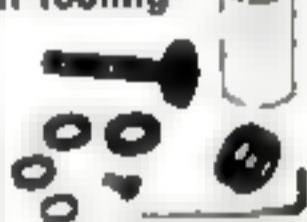
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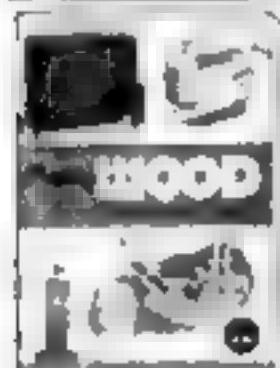
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Curing Vertical-Sweep Troubles [Continued from page 144]

"Convinced?" he asked.

"Nope," I said. "Try another 12BH."

"I've double-checked," he countered.

"Give it a triple check!" I ordered.

He snapped to and clicked his heels.

The next 12BH7 reduced the fold drastically. A slight adjustment of the vertical-linearity control cleared it altogether. Pete's face reddened.

"Sometimes," I explained, "even a double check won't stop a double cross when you're dealing with these 12BH7s. They can be a little gassy, and still check okay on the tester; work fine in other applications, but give trouble in the critical vertical-output spot."

The Case of the John Doe Clue

OUR county detective, Van Shanahan, lugged in a John Doe TV—a private-label set made for department-store sale. Usually you have no service information on them and repairs are made by ear.

Van said in clipped tones, "Had a few burglaries. All seem to be the work of one guy. Got a tip on where he was living, but he'd skipped. Left some loot behind. This TV is the only promising clue—has your sticker inside. Maybe you can pick his picture out of our file."

The set looked like a hundred others I had worked on, but I said, "I'll try, Van." Poking around inside, I spotted a vertical tube that jogged my memory.

The complaint had been not enough vertical sweep. I had tried a new 6SN7 in the vertical sweep with no luck. I had checked voltages and resistances and they had seemed reasonable. I couldn't be sure—it was a John Doe set.

Then I tried replacing the 6SN7 with a tube with similar characteristics but more muscle, a 6BL7. That did it.

I remembered now. The customer had picked up the set at the shop.

"Van, I think I've got your culprit."

I took out my handkerchief and pulled the 6BL7 and offered it to him.

"Art, I'm in no mood for jokes," he said wearily.

"I'm not joking. This customer was the suspicious type. Insisted on putting in a new tube himself—fresh out of the carton. You'll find his fingerprints on the glass envelope."

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How to Make and Use a GAB Meter

[Continued from page 158]

the construction: 1) accurate location of the liquid level line, 2) determining the precise amount of liquid required. Minor variations in other dimensions will be compensated for when you calibrate the instrument.

Turn the reservoir from brass stock. Drill the chamber with an accurately ground $\frac{5}{8}$ " twist drill to get the correct taper for the upper end of the hole. Scribe a line on the outside $\frac{1}{2}$ " from the lower end before the cap is soldered on. This is the liquid level line.

Solder the $\frac{1}{8}$ " o.d. brass tubing (this is the kind sold in telescoping sizes in model-airplane hobby shops) in the hole at the top of the chamber. Wrap a damp rag around the joint to keep the solder from melting while you solder the cap and $\frac{1}{4}$ " tubing to the bottom.

The large hole in the center of the large plastic panel is just to provide a convenient hand hold. Mount the support for the riser with four #4 flathead screws, drilled and tapped from the back. The $\frac{1}{8}$ " tubing fits snugly in a slot sawed in the face. Sliding the tubing and reservoir assembly up and down in this slot allows accurate adjustment of the position of the liquid level line. Two flathead screws adjacent to the slot clamp it in place when tightened.

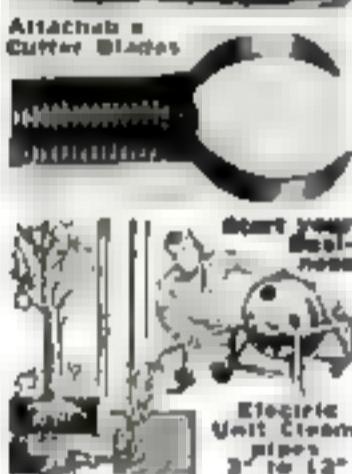
Make the mounting straps for the glass tubing by heating scraps of sheet plastic and bending to shape. Use short sections of rubber tubing around the glass under the straps. The suction cups are sold as replacements for car-top luggage carriers. Sand off the mounting face at an angle to compensate for the inward tilt of the car window. A little glycerin on the cups will make them stick better.

Tape a strip of paper to the plastic alongside the indicating column as a temporary scale. Scribe the zero mark on the paper and on the plastic so that you can later position your permanent scale accurately. If you don't have access to a miter gauge for calibrating, you can do it just as accurately (if less conveniently) by laying off the angles given in the table on a large sheet of cardboard. Tack the cardboard to a wall with the base line accurately leveled. Then align the bottom of the instrument with each angle in turn and mark the scale accordingly.



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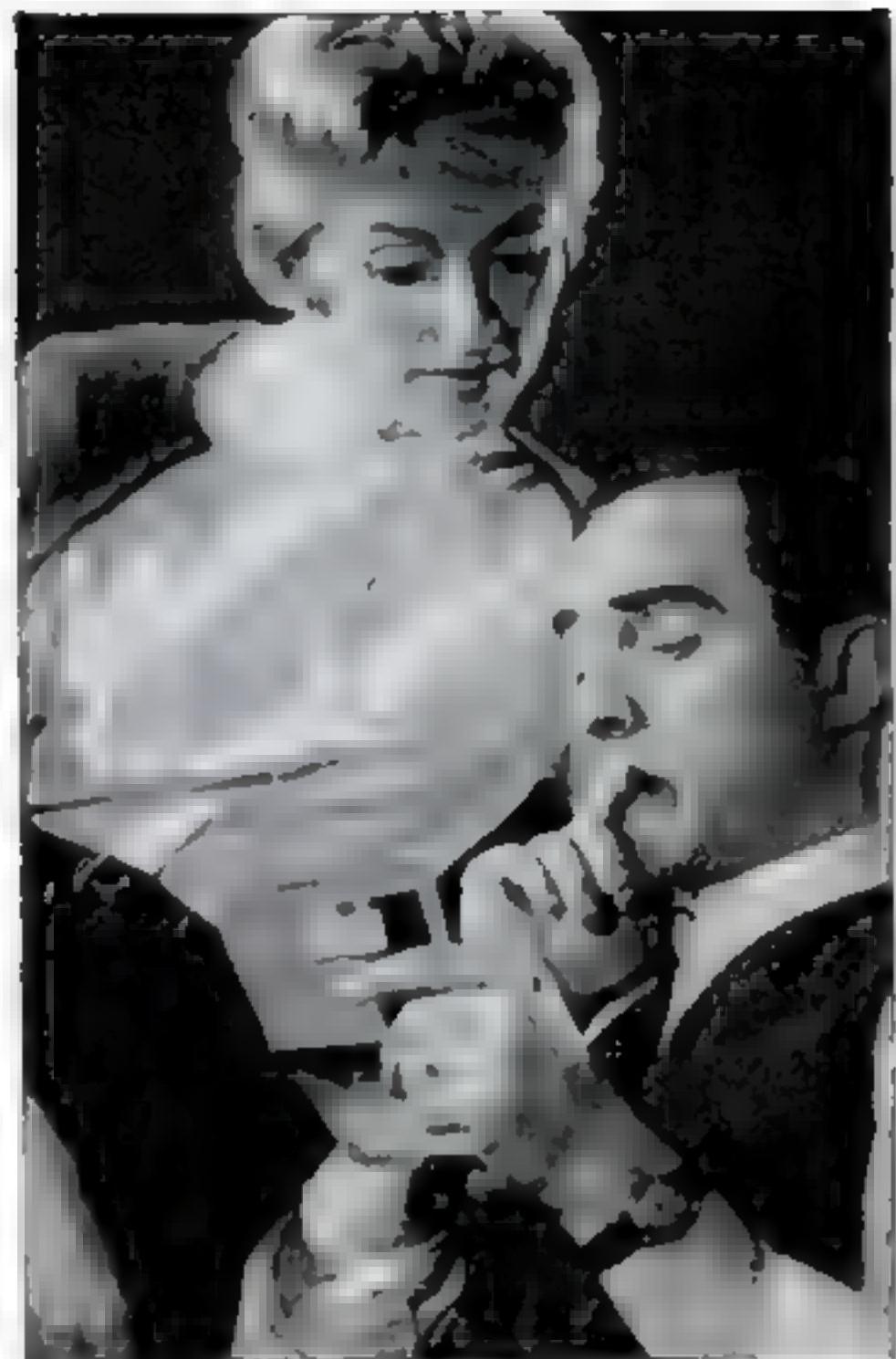


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Bass Fishermen!

"This Is The World's Finest Bass Catcher!"

By Paul Stag

THE WEEKEND FISHERMAN

How would you like to catch more bass than you ever caught in your life? How would you like to catch bass when they're not biting for other fishermen on the lake? How would you like to stop coming home empty handed?

I've been fishing for bass for over twenty-five years. I've tried just about every kind of lure I've ever seen in a store or in an advertisement. And just like you, I found that they caught some of the fish some of the time, but most of the time they caught nothing. But now I have found an imported lure that catches bass better than any lure I ever used!

I've caught bass time after time when other fishermen have come home empty handed. I've caught bass on the Vivif when even live bait failed! Vivif has caught bass for me at all hours of the day . . . in all kinds of weather. This amazing lure made bass bite. And now I've gotten the exclusive rights to introduce this lure in America and I'm out to prove my statement: "This is the finest bass lure ever invented."

A French Invention

This amazing lure was invented in France by a French sportsman who named it "Vivif". He spent years testing other kinds of lures on fish and watching how they reacted to each lure under water. Who ever did that before? From those years of testing this Frenchman developed Vivif . . . the patented lure with the "Live" tail.



1,055,000 Vivif Lures Already Sold!

Seldom if ever has a fish lure received such an exciting reaction from fishermen. Amazing catches have been reported. In England Vivif holds a British record! In 25 foreign lands Vivif is catching fish like magic. Already reports from fishermen in this country are coming in . . . reports saying Vivif is the greatest lure they have ever used. Fishermen in 25 countries can't be wrong. "Vivif is the finest lure I have used in 25 years of fishing!"

When he started selling Vivif in France it became one of the most famous fish lures in Europe! Soon its fame spread to 25 foreign lands! In came incredible reports of how Vivif caught fish.

Vivif holds a British record in England. It has made amazing catches in other countries.

Last winter I started importing Vivif to America. I gave it to expert, experienced fishermen to test. They reported, "We didn't believe it but it's true. Vivif caught fish when other lures failed." That's what hard boiled experts say.

But even more important to you is what other average fishermen say. Here's a typical letter . . . from Mr. Robert Hilton of Jacksonville, Florida. "I have used artificial lures from Canada to Florida and have worn out four spinning reels. The VIVIF is far superior to any lure that I have ever used. The day I used Vivif the bass were not biting, even on live shiners. I caught 5 bass on the lure and then lost it to a large bass. The bass broke water three times trying to throw the lure after he broke my 12 pound monofilament line."

From everywhere come their reports of how Vivif makes bass bite like magic . . . of the magic appeal it seems to have . . . of how it out-fishes and out-caughts any lure they have ever used.

Why is this true? Frankly I don't know. All I know is that Vivif is different from any lure you ever used. It's the world's most life-like lure in the water. It starts moving like a live minnow the instant it touches the water on a slackened line! And not only is it pure magic with bass, but it's just as terrific with other fish.

Think what this means to you. Now at last you can catch almost all kinds of fresh water gamefish as well as many salt water fish. You can do away with digging for worms, catching bugs, frogs or minnows. You can cast, troll, shore fish . . . all with equal success. You can go out after . . . and come back with largemouth bass, smallmouth bass, pike, pickerel, perch, trout, salmon, musky, and walleyes and do it time and again . . . or your money will be refunded at any time!

Marvel Of Design

Not just another stiff plastic or wood lure that "looks good" but doesn't work. Vivif is made of life-like lures and is the world's most lifelike lure in the water . . . works better than live bait! Color combinations have been carefully selected in actual tests. Perfectly balanced. Vivif doesn't spin . . . never twists your line. Acts and wiggles like a live minnow the instant it touches the water.

AMAZING TRIAL OFFER!

No longer do you have to come home empty handed from your fishing trips. Try amazing Vivif . . . the French lure designed to attract and catch fish . . . without risking a penny.

All you do is mail the amazing no-risk trial coupon below. When you receive your Vivifs, use them anywhere you like . . . use



HOW VIVIF WORKS

Bass have never seen anything like this lure before. It attracts bass by its "feeling" tail. It is the world's most attractive lure in the water. Fish can't resist it . . . and when they grab the lure it "feels lifelike" — doesn't warn them to spit it out before you can sink the hook in! Read this article and learn the amazing story of this imported lure.

them as often as you like . . . to prove its fantastic fish-catching powers.

Use it to catch bass, trout, perch, pike, walleyes . . . and many other fresh water sport and panfish you like to catch plus many salt water game fish.

Let your children and friends fish with Vivif. Put Vivif to every test. If you don't agree it is the finest lure you've ever used . . . if it doesn't catch more fish and bigger fish, you have used it entirely free. It won't cost you a penny. Read amazing trial offer below.

VIVIF IS IMPORTED SUPPLIES ARE LIMITED

To get your Vivifs now, mail the Amazing no-risk trial coupon below. U. S. supplies are still limited. Order now to be sure you'll have your Vivifs in time for your next fishing trip. Only if you act at once can I guarantee to fill your order immediately. Don't delay. Mail amazing trial coupon today.

Mail Amazing No-Risk Trial Coupon

Harrison Home Products Corp., Dept. S-PS
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8 Ringland Avenue, Harrison, New Jersey

Please send VIVIF's checked below on AMAZING TRIAL OFFER. If VIVIF does not catch more fish . . . bigger fish . . . and make fishing more fun—if VIVIF is not the greatest lure I've ever used you will refund my money immediately . . . including postage.

Quan.	Size	Weight	Color Comb.	Price
2	1/4"	1/8 oz.	Green-Silver-Red	\$1.35
2	1/4"	1/8 oz.	Black & Gold	\$1.35
2	1/4"	1/8 oz.	Green-Gold-Red	\$1.35
2	1/4"	1/8 oz.	Red & White	\$1.35
SAVE! ALL 4 THIS SIZE FOR \$4.95				

2"	1/2 oz.	Brown-Silver-Red	\$1.65
2"	1/2 oz.	Black-Silver-Red	\$1.65
2"	1/2 oz.	Green-Gold-Red	\$1.65
2"	1/2 oz.	Red & White	\$1.65
SAVE! ALL 4 THIS SIZE FOR \$5.95			

3 1/2"	2 1/2 oz.	Green & Yellow	\$2.45
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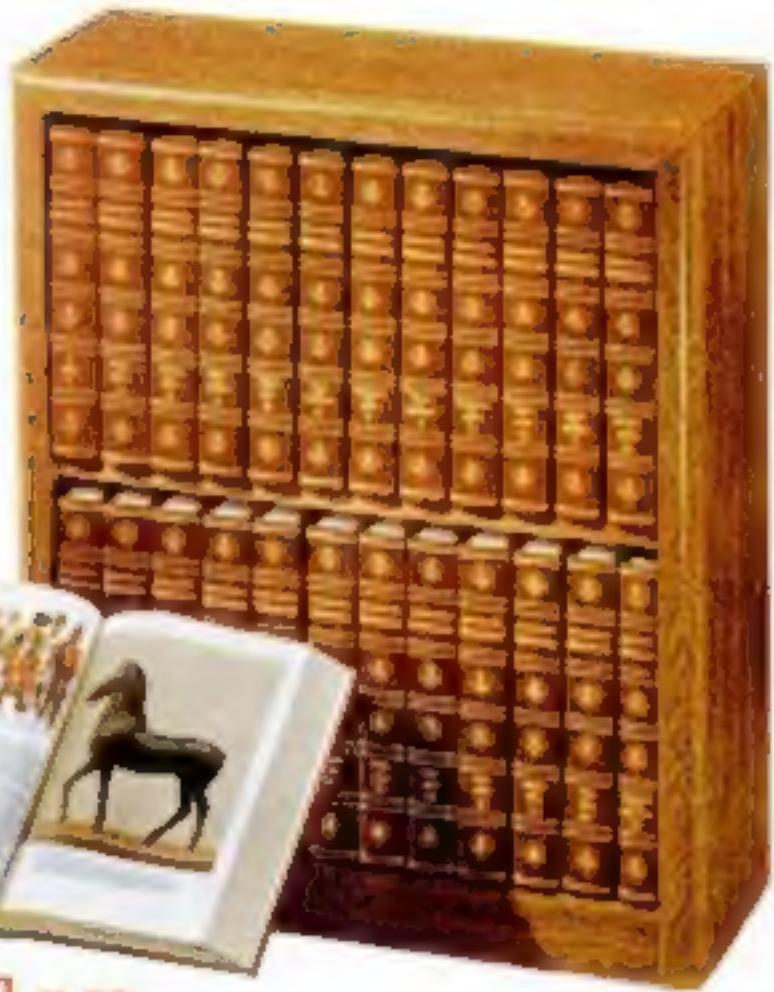


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